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SEWAGE STABILIZATION PONDS IN THE DAKOTAS VOLUME II (APPENDICES)

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

1957

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SEWAGE STABILIZATION PONDS IN THE DAKOTAS

VOLUME II

A JOINT REPORT WITH THE
NORTH AND SOUTH DAKOTA DEPARTMENTS OF HEALTH

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
1957

SEWAGE STABILIZATION PONDS IN THE DAKOTAS

An evaluation of the use of stabilization ponds as a method of sewage disposal in cold climates

Volume II
(Appendices)

A Joint Report
with

North Dakota
Department of Health
Bismarck, North Dakota

South Dakota
Department of Health
Pierre, South Dakota

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of State Services
Division of Sanitary Engineering Services

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

1957

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(Appendices)

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APPENDIX A

Pertinent Information on Five Ponds
Subjected to Seasonal Investigation

Summary of Pertinent Information
Kadoka, South Dakota

Sewage and Sewerage

Population served:	584 (1950 Census)
Sewer system:	Separate - gravity.
Pretreatment:	None
Industrial Wastes:	Abattoir — slaughters average 300 beef and 50 hogs per year; about 50% during October, November and December.
Sewage: Flow:	21,100 G.P.D.
Strength:	380 ppm B.O.D.
Loading:	68.7 pounds B.O.D. per day, or 22.9 lbs. per acre per day.

Pond *

Date Completed:	Fall, 1953.
Design Engineer:	Fred Brady, Spearfish, South Dakota
Description:	Single cell, irregular shape (ox-bow) and depth. Area: 3.0 acres; Ave. Depth: 4.45 ft.; Volume: 18.1 acre-ft.
Inlet Structure:	Location: at end of peninsula (see sketch) Discharge: horizontal, 1 1/2' below operating level.
Outlet Structure:	Location: NW corner. Depth: Surface.
Dikes:	Top width: 14' Slope: inside: 1:1; outside: 1:1 1/2 to 1:3 to 1:3
	Diversion ditch prevents entry of surface run-off into lagoon.
Environs:	Nearest residence: 1400' North Community: 1500' South
	Fenced: yes, but not adequate to keep out cattle. Posted: no signs.

* Note: This installation was abandoned in the Spring of 1956, when the raw sewage was diverted to a new pond.

Costs:	Land (20 acres at $50.00)			1000.00
	Excavation (2250 cu yd at $0.60)			1350.00
	Fence (100 rods at $3.00)			300.00
				2650.00
	Sewer 285' of 10" VCP in 0 to 6' trench		712	
	76' " " " " 6 " 8 "		209	
	77' " " " " 8 " 10 "		231	3532.00
	327' " " " " 10 " 12 "		1440	
	Std M.H., 3 at 250		750	
	Extra M.H. depth 9.5' at $20.00		190	
		Engineer		890.00
		Misc.		142.00
		Total		$7214.00
		(12.35 per capita)		

Soil Conditions:

Type: Clay

Mechanical Soil Analyses*: Sand: 25.7%
Silt: 41.5%
Clay: 32.8%

Bottom was not "sealed"

Effluent: Not recirculated
Erratic flow due to wind and occasional clogging of outlet pipe. Ave. flow observed during 1955 studies: 13,600 GPD (Spring: 4800 GPD; Summer: 16,800 GPD; Fall: 19,100 GPD)

Wildfowl: Frequented by shore birds and ducks.

Odors: Yes during spring, summer and fall.

Operation and Maintenance: None to date.

Weather (1955):

Evaporation**	Total 72.4
Precipitation	Total 16.3
Temperature	Ave. 48.2°F; Max. 106°F; Min. -15°F

Prevailing winds from NW

Elevation: 2467

* Soils Laboratory, Bureau of Reclamation, Bismarck, North Dakota
** Cottonwood Station

Municipal Water Supply of Kadoka, South Dakota

Source: Well, 2670 feet deep. Constructed in 1951.

Population Served: 580

Daily Consumption: 18,700 Gal. (Ave. for 1954 metered flow).

Treatment: Chlorination.

Chemical Analyses * (ppm)

Total Dissolved Solids	1841.
Total Alkalinity (as $CaCo_3$)	150.
Total Hardness (as $CaCo_3$)	222.
Iron (Fe)	0.0
pH	7.65
Calcium (Ca)	66.5
Magnesium (Mg)	13.5
Sodium (Na)	511.
Fluoride (F)	1.4
Chloride (Cl)	72.
Sulfate (SO_4)	1038.
Bicarbonate (HCO_3)	183.
Nitrates (NO_3)	2.0
Carbonates (CO_3)	---
Manganese (Mn)	0.0

* Analyses made by South Dakota Health Department - January 28, 1954.

Municipal Personnel

Kadoka, South Dakota
(1955)

Mayor:	Dr. N. J. Sundet
Auditor:	Wesley Herrman
Water and Sewage Works:	Roy Hedeen
Treasurer: (and local weather observer)	Mr. Colburn
Other persons contacted:	Mr. Nielsen, meat packer (only one in Kadoka).

Summary of Pertinent Information
Wall, South Dakota

Sewage and Sewerage

Population Served:		556 (1950 Census)
Sewer System:		Separate - gravity.
Pretreatment:		None
Industrial Wastes:		None
Sewage:	Flow:	24,900 G.P.D.
	Strength:	315 ppm B.O.D.
	Loading:	62.2 Pounds B.O.D. per day, or 7.0 lbs. per acre per day.

Surface run-off does not reach pond.

Pond

Date Completed:	Fall, 1951.
Design Engineer:	Staven, Rapid City, South Dakota
Description:	One cell used, although three are available. Shallow, irregular 5-sided polygon. Area: 8.87 acres; Ave. depth: 14 inches; Volume: 10.7 acre-ft.
Inlet Structure:	Side discharge from east section of North dike.
Outlet Structure:	Shallow ditch connected to next cell. (SE) (Very little flow, depending on wind direction.)
Dikes:	Ave. top width: 4 ft.; ave. height: 6 ft. Slope: inside: 4:1; outside: 2:1.
Environs:	Nearest residence: 1000' West. Community: 2000' WSW.
	Area is fenced but not posted.

Costs: Land (City owned 25 acres)
Excavation (3700 cu. yds.) $2400.00

Other costs (sewer system, fence, outfall, etc.) $12600.00
Total cost $15000.00

($26.98 per capita)

Soil Conditions:
Type: "Gumbo"
Mechanical Soil Analyses*: Sand: 6.3%
Silt: 68.7%
Clay: 25.0%

Effluent: None

Wildfowl: Shorebirds and ducks.

Odors: None noticed during survey.

Operation and Maintenance: None to date.

Weather (1955):
Evaporation** Total 71.4
Precipitation** Total 13.9
Temperature** Ave. 47.3°F; Max. 108°F; Min. -17°F

Ice Cover: Nov. 15 - April 1 (4 1/2 months)

Elevation: 1934' above sea level.

* Soils Laboratory, Bureau of Reclamation, Bismarck, North Dakota.
** Cottonwood Weather Station.

Municipal Water Supply of Wall, South Dakota

Source: Surface, stock dam construction, 1 1/2 miles NW of town.

Population Served: 560

Daily Consumption: 26,000 GPD (Ave. of 1954 -- 98% metered)

Treatment: Coagulation -- Filtration -- Chlorination.

Chemical Analyses * (ppm)

Total Dissolved Solids	207.
Total Alkalinity (as $CaCo_3$)	154.
Total Hardness (as $CaCo_3$)	75.5
Iron (Fe)	0.0
pH	8.0
Calcium (Ca)	24.0
Magnesium (Mg)	2.8
Sodium (Na)	55.5
Fluoride (F)	0.6
Chloride (Cl)	11.0
Sulfate (SO_4)	17.4
Bicarbonate (HCO_3)	193.
Nitrates (NO_3)	0.0
Carbonates (CO_3)	---
Manganese (Mn)	0.0

* Analyses performed by South Dakota State Department of Health, Nov. 16, 1953.

Municipal Personnel

Wall, South Dakota
(1955)

Mayor:	O. S. Soma
Auditor:	Deane Joyce
Water and Sewage Works:	Harold Welsh

Summary of Pertinent Information
Lemmon, South Dakota

Sewage and Sewerage

Population Served:		2760 (1950 Census)
Sewer System:		Combined - gravity.
Pretreatment:		None.
Industrial Wastes:		Two abattoirs Ave. no. animals processed annually: 400 beef, 350 hogs, and 200 deer.
Sewage:	Flow:	125,500
	Strength:	186 ppm B.O.D.
	Loading:	186 pounds B.O.D. per day, or 6.8 lbs. per acre per day.
		Combined sewers conduct about 50% of City rain run-off.

Pond

Date Completed:	Summer, 1951.
Design Engineer:	Staven, Rapid City, South Dakota.
Description:	Single cell, irregular shape and depth. Area: 27.1 acres; Ave. depth: 5.7'; Volume: 154 acre-ft.
Inlet Structure:	Submerged, 1000' West of outlet. Depth 3'.
Outlet Structure:	Surface discharge, SE corner.
Dikes:	Inside slope 1.5:1; supports roadway.
Environs:	Nearest residence: 1/2 mile WSW Community: 1 mile SW.
	Area is fenced but not posted.

Costs:

Land (1/4 section)	2000.00
Excavation (47,572 cu. yds. @ 0.40)	19029.00
	$21029.00
Other costs (Fees, sewers, etc.)	12754.00
Total:	$33783.00
($12.20 per capita)	

Soil Conditions:

Type: Silty Clay

Mechanical Soil Analyses: Sand: 34.5%
Silt: 38.5%
Clay: 27.0%

Effluent: Discharges to branch of Cedar Creek.
(Ave. summer flow: 14,590 GPD)

Wildfowl: Many ducks and shorebirds.

Odors: Occasionally noticed along feathered shore of SW cove.

Operation and Maintenance: Trash and rocks are dumped along inner dikes to act as rip rap.

Weather (1955):

Evaporation:	Total 58.8" *
Precipitation:	Total 17.3"
Temperature:	Ave. 41.5°F; Max. 101°F; Min. -21°F.
Ice cover:	Nov. 1 - April 1 (five months)

Elevation: 2518

* Shadehill Station.

Municipal Water Supply of Lemmon, South Dakota

Source: 5 wells, 185-915' deep.

Population Served: 2760; no meters.

Daily Consumption: 500,000 Gal. (est. based on pump rates)

Treatment: None.

Chemical Analyses* (ppm) (average of five wells)

Total Dissolved Solids	1498.
Total Hardness (as $CaCo_3$)	180.
Iron (Fe)	0.5
pH	8.3
Calcium (Ca)	8.4
Magnesium (Mg)	2.5
Sodium (Na)	560.
Fluoride (F)	2.8
Chloride (Cl)	91.
Sulfate (SO_4)	362.
Bicarbonate (HCO_3)	903.
Nitrate (NO_3)	0.2
Carbonate (CO_3)	---
Manganese(Mn)	---

* Analyses by South Dakota State Department of Health.

Municipal Personnel

Lemmon, South Dakota
(1955)

Mayor:	J. C. Jacobsen
Auditor:	E. C. Gustafson
Water and Sewage Works:	Al Robinson "Bud" Dosland
Treasurer:	Mr. Cornish
Other persons contacted:	Mrs. Stewart, local weather observer. Mr. "Nick" Biersbach, meat packer. Mr. George Wenzel, meat packer.

Summary of Pertinent Information
Maddock, North Dakota

Sewage and Sewerage

Population Served:	741 (1950 census)
Sewer System:	Separate -- lift station.
Pretreatment:	None.
Industrial Wastes:	Dairy (400 Gal. per day) Meat packer (300 beef, 100 hogs, annually)
Sewage: Flow:	50,200 G.P.D.
Strength:	267 ppm B.O.D.
Loading:	109 pounds B.O.D. per day, or 9.3 lbs. per acre per day in first pond.

Pond

Date Completed:	Fall, 1949.
Design Engineer:	Lium and Burdick

Description: Three rectangular cells in series.

First:	Area, 11.7 acres;	Ave. depth,	4.0';	Vol.	46.8	acre-ft.
Second:	" 12.3 acres;	" "	2.8';	"	34.4	acre-ft.
Third:	" 8.0 acres;	" "	4.4';	"	35.2	acre-ft.
	32.0				116.4	

Inlet Structure:	Submerged (3' depth) in center of first cell.
Outlet Structure:	None (no effluent)
Dikes:	Top width: 10' Slope: inside: 1:4; outside: 1:2.
Environs:	Nearest house: 3000' E. Community: 1 mile E.

Costs:	Land (65 acres @ $100.00)		6500.00
	Excavation	First Cell	5000.00
		Second "	600.00
		Third "	4400.00
			$16500.00
		($92.30 per capita)	
	Lift Station		9500.00
	Force Main (3000' 2.95)		8850.00
			$18350.00
	Total cost (excluding $49,130 for sewers)		$34850.00
		($46.90 per capita)	

Soil Conditions:

Type: Clay-Silt

Mechanical Soil Analyses*: Sand: 22.8%
Silt: 56.3%
Clay: 20.9%

Was not necessary to seal bottom.

Wildfowl: Many ducks.

Odors: From first pond during winter-spring transition.

Operation & Maintenance: Cutting weeds on dikes.

Weather (1955):

Evaporation **	Total 32.9"
Precipitation	Total 17.1"
Temperature	Ave. 38.5°F; Max. 100; Min -32°F

Elevation: 1604

* Soils Laboratory, Bureau of Reclamation, Bismarck, North Dakota.

** Devils Lake Weather Station.

Municipal Water Supply of Maddock, North Dakota

Source: 2 wells, 60-64 feet deep.

Population Served: 740

Daily Consumption: 43,000 Gal.(Ave. of 1954)

Treatment: None

Chemical Analyses

Total Dissolved Solids	915
Total Alkalinity (as $CaCo_3$)	336
Total Hardness (as $CaCo_3$)	260
Iron (Fe)	1.4
pH	7.6
Calcium (Ca)	61.6
Magnesium (Mg)	26
Sodium (Na)	158
Fluoride (F)	Trace
Chloride (Cl)	10
Sulfate (SO_4)	244
Bicarbonate (HCO_3)	410
Nitrates (NO_3)	2.1
Carbonates (CO_3)	---
Manganese (Mn)	---

Municipal Personnel

Maddock, North Dakota
(1955)

Mayor:	P. W. Utgaard
Auditor:	A. P. Lysne
Water & Sewage Works:	Firemann Leigrid
Former Water & Sewage Works:	Elmer Larsen
Other persons Contacted:	Mr. Jacobsen, Mgr., of Co-op Dairy. Mr. Schmid, local meat packer (only one in Maddock) Mr. George Sheets, R.R. Section Foreman -Furnished ice for sample preservation.

Summary of Pertinent Information
Wishek, North Dakota

Sewage and Sewerage

Population Served:	1241 (1950 census)
Sewer System:	Separate — gravity.
Pretreatment:	None
Industrial Wastes:	None
Sewage: Flow:	57,200 G.P.D.
Strength:	207 ppm B.O.D.
Loading:	102 pounds B.O.D. per day, or 13.0 lbs. per acre per day.

Pond

Date Completed:	October 20, 1952.
Design Engineer:	Paul Barnes, Valley City.
Description:	Single Cell, approx. square shape. Area: 7.8 acres; Depth (ave.) 3.0'; Volume: 22.4 acre-ft.
Inlet Structure:	50' from East dike, Horizontal, 8" off bottom.
Outlet Structure:	In West dike, 1' off bottom. Valve is opened about twice a year, "When high level of liquid in ponds backs up sewers."
Dikes:	Top width: 14' Slope: inside: 1:4; outside: 1:3.
Environs:	Nearest residence: 300 yds. East. Community: 500 yds. East.

Cost: Land — already owned by City.

Total cost of lagoon. $5400.00

Cost per capita: $4.50

Soil Conditions:

Type: Silty-clay

Mechanical Soil Analyses: Sand: 16.1%
Silt: 59.6%
Clay: 24.3%

Wildfowl: Ducks.

Odors: Not noticeable during survey.

Operation and Maintenance: Some rip rapping.

Weather (1955):

Evaporation*	Total 43.2
Precipitation	Total 18.3
Temperature	Ave. 40.4°F; Max. 100°F; Min. -32°F.

Elevation 2010

* Edgeley Exp. Farm Weather Station.

Municipal Water Supply of Wishek, North Dakota

Source:	Dug well, 12' diam. x 33' deep.
Population served:	Approx. 1200.
Daily Consumption:	85,000 Gal. (Ave. of year 1952).
Treatment:	None.

Chemical Analyses *

Total Dissolved Solids	509
Total Alkalinity (as $CaCo_3$)	260
Total Hardness (as $CaCo_3$)	340
Iron (Fe)	3.1
pH	8.0
Calcium (Ca)	101
Magnesium (Mg)	21
Sodium (Na)	---
Fluoride (F)	---
Chloride (Cl)	14
Sulfate (SO_4)	52
Bicarbonates (HCO_3)	317
Nitrates (NO_3)	---
Carbonates (CO_3)	---
Manganese (Mn)	---

* From files of North Dakota State Department of Health.

Municipal Personnel

Wishek, North Dakota
(1955)

Mayor:	Elmo Nickisch
Water and Sewage Works:	Carl Eissinger

APPENDIX B

Field Observations

FIELD OBSERVATIONS
Spring 1955

KADOKA, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (% cover)	Wind Direc.	Wind Velo. Beaufort	Flows Raw Sew. Flow (GPM) *	Flows Efflu. Flow (GPM) **	Pond Temp (°C)	Effluent pH	Effluent D.O.
4/26/55	1400	---	0	SSE	4	---	---	---	---	16.0
(Tues)	1600	---	0	---	---	---	---	20	8.6	15.7
	1800	23.3	Dusk	SSE	4	21.2	3.96	19	8.6	11.1
	2000	23.3	Dark	SSE	4	16.8	4.28	18	8.4	8.9
	2230	22.8	"	SSE	5	8.1	3.96	17	8.3	6.1
	2400	17.2	"	NW	5	4.1	3.49	16	8.1	0.6
4/27/55	0200	10.0	"	NW	5	0.3	3.80	14	8.0	0.0
(Wed.)	0400	10.0	Dawn	NW	5	0.2	3.01	13	8.1	0.0
	0600	11.1	5	NW	5	3.4	3.33	14	8.1	0.4
	0800	13.9	10	NW	5	12.6	3.01	15	8.1	0.7
	1000	15.6	10	NW	5	22.4	3.33	15	8.1	3.2
	1200	16.7	20	NW	6	18.7	2.66	16	8.2	3.0
	1400	16.7	100	W	6	24.2	2.63	16	8.3	3.7
	1600	17.2	100	NW	6	21.8	2.22	16	8.2	2.8
	Max.	23.3	---	---	6	24.2	4.28	20	8.6	16.0
	Min.	10.0	---	---	4	0.2	2.22	13	8.0	0.0
	Ave.***	16.5	---	---	5	12.8 (18,500 gpd)	3.31 (4,800 gpd)	15.7	8.2	3.4

* Raw flow measured by area-velocity method
** Effluent measured by volume-time method
*** Ave. of 24 hour period from 1800 4/26 through 1600 4/27

FIELD OBSERVATIONS
Summer 1955

KADOKA, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Flows Raw (gpm)*	Flows Effluent (gpm)*	Pond Effluent Temp. (°C)	Pond Effluent pH	Pond Effluent D.O. (ppm)	Pond Effluent Time
8/1/55	0910	---	---	---	---	---	23	12	28	---	---	0900
(Mon)	1000	---	---	---	---	---	---	---	---	---	---	1000
	1100	38.9	0		SSW	3	21	12	31	---	17.1	1100
	1200	38.9	0		S	4	21	12	32	---	23.5	1200
	1300	38.9	0		S	3	16	12	32	---	19.5	1300
	1400	40.0	20		SW	4	21	3	31	---	16.9	1400
	1500	41.1	90		S	5	14	7	30	9.4	17.2	1400
	1600	35.0	100		SE	2	23	4	29	9.3	10.0	1600
	1700	34.4	100		E	2	21	14	29	9.3	9.5	1700
	1800	32.2	100		E	2	18	16	29	9.4	8.3	1800
	2000	30.6	Dark		SSW	2	23	14	28	9.4	4.0	2000
	2200	28.9	"		SSE	2	23	16	27	9.2	0.0	2200
	2400	30.6	"		SSE	3	6	21	27	9.2	0.0	2400
8/2/55	0200	29.4	"		W	2	2	18	27	9.1	0.0	0200
(Tues)	0400	27.8	Dawn		S	3	5	18	26	9.1	0.0	0400
	0500	28.3	90		S	3	12	18	26	9.1	0.0	0500
	0600	28.3	100		SSW	3	10	12	26	9.0	0.0	0600
	0700	29.4	50		WSW	3	18	12	26	9.1	0.0	0700
	0800	32.2	50		W	3	24	12	26	8.9	0.0	0800
	0900	31.1	30		SW	3	21	12	26	9.1	0.0	0900
	1000	33.3	20		WNW	2	41	12	26	9.1	0.0	1000
	1130	36.7	40		W	3	23	14	29	9.1	0.0	1130
	1200	36.1	60		W	3	23	12	26½	8.85	0.0	1200
	1300	36.7	70		W	2	12	10	28	9.4	0.0	1300

FIELD OBSERVATIONS
Summer 1955 (Continued)

KADOKA, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Flows Raw (gpm)*	Flows Effluent (gpm)*	Pond Effluent Temp. (°C)	Pond Effluent pH	Pond Effluent D. O. (ppm)	Time
8/2/55	1400	37.8	60		NW	2	16	12	29	9.45	2.1	1400
(Tues)	1500	38.9	10		W	2	15	12	30	9.4	5.8	1500
(cont.)	1600	40.0	40		W	2	14	12	30	9.7	13.1	1600
	1700	36.7	80		NW	3	25	10	29	9.6	5.0	1700
	1800	33.9	Dark		NNE	2	23	10	28	9.5	0.0	1800
	2000	30.6	"		S	3	20	10	28	9.4	9.5	2000
	2200	27.2	"		SSW	2	18	10	27	9.2	4.1	2200
	2400	26.7	"		SW	2	7	10	26	9.1	4.0	2400
8/3/55	0200	24.4	"		NW	1	3	10	25½	9.1	1.0	0200
(Wed)	0400	24.4	Dawn		SSW	2	4	10	25½	9.0	0.0	0400
	0500	24.4	50		SSW	2	10	10	25½	9.0	0.0	0500
	0600	26.1	10		S	2	18	10	25	9.1	0.6	0600
	0700	28.3	50		S	3	16	10	26	9.1	2.3	0700
	0800	27.8	80		S	3	32	6	27	9.1	0.0	0800
	0900	30.0	60		SSW	3	24	8	26	9.2	0.6	0900
	1000	32.2	20		S	2	22	18	28	9.1	7.0	1000
	1100	35.0	30		S	3	24	10	29	9.3	7.1	1100
	1200	36.1	10		S	4	24	7	29	9.4	13.5	1200
	1300	37.8	10		SSE	3	23	10	30	9.6	22.1	1300
	1400	38.9	5		S	3	23	10	32	9.6	14.4	1400
	1500	40.0	5		SW	3	18	10	32	9.6	21.6	1500
	1600	40.0	50		SW	3	17	10	29	9.3	6.6	1600
	1720	40.0	35		W	2	31	10	30	9.4	9.3	1720
	1800	38.9	35		W	1	32	10	29	9.3	11.5	1800

FIELD OBSERVATIONS
Summer 1955 (Continued)

KADOKA, SOUTH DAKOTA

Date	Time	Weather: Air Temp. (°C)	Weather: Sky (%cover)	Weather: Light Intensity	Wind: Direc.	Wind: Velo. Beaufort	Flows: Raw (gpm)*	Flows: Effluent (gpm)*	Pond Effluent: Temp. (°C)	Pond Effluent: pH	Pond Effluent: D. O. (ppm)	Time
8/3/55	2000	29.4	25		---	0	26	10	28	9.4	10.8	2000
(Wed)	2400	25.6	Dark		WNW	----	7	8	26	9.2	3.3	2400
(cont.)												
8/4/55	0200	23.9	"		NW	4	6	8	26	9.1	0.0	0200
(Thurs)	0400	21.1	Dawn		NW	4	7	8	25	9.1	0.0	0400
	0500	21.1	10		NW	4	18	10	26	9.0	0.0	0500
	0600	21.7	5		NW	4	27	---	---	---	---	0600
	Max.	41.1	---		---	5	41	21	32	9.7	23.5	
	Min.	21.1	---		---	0	2	3	25	8.85	0.0	
Ave.(8/1-4)		30.9	---			18.1(26,000gpd)		11.7(16,800gpd)	27.7	9.2	5.4	
Ave.(8/1-2)		32.5	---			16.7(24,000gpd)		14.1(20,300gpd)	28.1	9.2	6.1	
Ave.(8/2-3)		29.6	---			17.1(24,600gpd)		11.2(16,150gpd)	27.1	9.2	2.7	
Ave.(8/3-4)		30.7	---			20.4(29,400gpd)		9.7(13,950gpd)	27.9	9.3	7.7	

* Raw and effluent flow measured by 90° V-notch weir.

FIELD OBSERVATIONS
Fall 1955

KADOKA, SOUTH DAKOTA

Date	Time	Flows: Raw Head on 90° Weir (Ft)	Flows: Raw Flow (gpm)	Flows: Effluent Head on 90° Weir (Ft)	Flows: Effluent Flow (gpm)
11/10	1230	0.17	14	0.17	14
	1400	0.19	18	0.17	14
	1500	0.15	10	0.17	14
	1600	0.16	12	0.17	14
	1700	0.19	18	0.17	14
	1800	0.17	14	0.17	14
	2100	0.16	12	0.17	14
	2400	0.16	12	0.17	14
11/11	0300	0.16	12	0.17	14
	0600	0.16	12	0.16	12
	0700	0.17	14	0.16	12
	0800	0.14	8.5	0.16	12
	0900	0.16	12	0.16	12
	1000	0.18	16	0.16	12
	1100	0.18	16	0.16	12
Max.			18		14
Min.			8.5		12
Ave.		13.4(19,300gpd)		13.3(19,100gpd)	

FIELD OBSERVATIONS
Spring 1955

WALL, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (% cover)	Wind Direc.	Wind Velo.*	Flow Raw Sewage ** (gpm)	Pond * Temp. (°C)	Pond * pH	Pond * D. O. (ppm)
4/28/55 (Thurs)	1000	11.7	15	SW	3	21.2	---	---	---
	1200	14.4	15	SW	2	15.6	---	---	---
	1400	15.6	10	SW	2	19.1	---	---	---
	1600	17.8	10	SW	2	15.0	---	---	---
	1800	16.1	5	S	1	15.2	---	---	---
	2000	6.7	Dark	Calm	0	12.4	11.5	---	15.9
	2200	5.0	"	"	0	10.7	8	---	11.4
	2400	5.0	"	S	1	11.1	8	---	11.5
4/29/55 (Fri)	0200	3.3	"	Calm	0	5.3	7	---	9.4
	0400	2.8	Dawn	"	0	5.3	7	---	9.6
	0600	11.1	0	S	1	---	7	---	16.2
	0800	16.7	50	S	4	15.0	---	---	21.9
	1000	16.7	Dust Haze	SE	5	21.6	17	---	18.6
	1100	26.1	" "	SE	5	16.3	19	---	20.8
	1300	27.8	" "	SE	6	23.8	19	---	18.7
	1500	27.2	100	S	6	15.1	20	---	18.4
	1700	27.2	Dust Storm	S	6	12.9	18	---	13.6
	1900	24.4	Dusk	S	6	12.9	16	---	10.9
	2100	21.7	Dark	S	5	13.2	16	---	9.5
	2300	21.7	"	S	6	14.9	16	---	4.4
4/30/55 (Sat)	0100	20.0	"	S	4	5.0	15	---	2.1
	0300	18.9	"	SW	2	3.8	15	---	2.9
	0500	18.9	100	S	2	2.9	15	---	3.1
	0700	15.0	100	NW	3	4.9	14	---	5.2

FIELD OBSERVATIONS
Spring 1955 (continued)

WALL, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (% cover)	Wind Direc.	Wind Velo.*	Flow Raw Sewage ** (gpm)	Pond Temp. (°C)	Pond pH	Pond D. O. (ppm)
4/30/55	0900	20.0	Dust Haze	NW	3	15.7	15	---	10.0
(Sat)	1100	26.1	" " ***	S	2	---	19	---	17.6
(cont.)	1300	28.3	" "	S	2	---	23	---	22.9
	1500	28.3	" "	SW	1	---	21	---	26.9
	1700	26.7	" "****	SE	1	---	25	---	39.8
Max. 4/28-30		28.3	---	---	6	23.8	25	---	39.8
Min. "		2.8	---	---	0	3.3	25	---	2.1
Ave. "		16.4	---	---	12.8(18,500 gpd)		15.2	---	14.2
Ave. 4/28-29		10.5	---	---	13.2(18,900 gpd)		---	---	---
Ave. 4/29-30		22.4	---	---	12.6(18,100 gpd)		16.5	---	10.0

* Beaufort scale.
** Raw sewage flow measured by volume-time method.
*** Bright sun despite dust haze.
**** Sun barely visible.

FIELD OBSERVATIONS
Summer 1955

WALL, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Head on 90°Weir (ft.)	Raw Sewage Flow (gpm)	Pond Temp. (°C)	Pond pH	Pond D. O. (ppm)
8/6/55	0800	21.1	25		NW	3	0.223	27	24	---	3.8
(Sat)	0900	25.0	20		NNW	4	0.219	26	24	---	5.1
	1000	26.7	20		N	4	0.212	24	29	---	15.3
	1100	26.7	30		NE	4	0.248	35	31	---	18.2
	1200	26.7	20		NE	4	0.220	26	31.5	---	21.0
	1300	27.8	20		N	3	0.209	23	33	---	23.6
	1400	29.4	40		N	3	0.213	24	33	---	26.2
	1500	31.7	40		N	3	0.223	27	32	---	26.8
	1600	31.1	30		N	3	0.227	28	31.5	---	21.2
	1700	30.0	20		N	3	0.245	34	30	---	19.6
	1800	27.2	10		NNE	4	0.214	24	27	---	15.0
	2000	22.8	Dark		NE	3	0.283	49	24	---	12.0
	2200	20.0	"		E	3	0.231	29	20.5	---	6.8
	2400	17.8	"		E	3	0.171	14	19	---	0.0
8/7/55	0200	15.0	"		ESE	2	0.125	6	18	---	1.4
(Sun)	0400	12.2	Dawn		E	2	0.102	4	17	---	0.4
	0500	15.6	20		ESE	2	0.102	4	16	---	0.5
	0600	17.8	95		SE	1	0.126	5	16	---	2.5
	0800	21.1	100		SE	3	0.223	27	19	9.8	7.0
	0900	22.8	95		E	4	0.213	23	20	9.8	9.5
	1000	25.0	95		SE	3	0.200	21	22	9.8	10.6
	1100	26.1	98		SE	4	0.224	27	24	9.8	15.2
	1200	27.2	95		SSE	4	0.212	24	25	9.9	17.0

FIELD OBSERVATIONS
Summer 1955 (Continued)

WALL, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Head on 90°Weir (ft.)	Raw Sewage Flow (gpm)	Pond Temp. (°C)	Pond pH	Pond D. O. (ppm)
8/7/55	1300	28.3	90		SSW	3	0.214	34	27	9.9	17.5
(Sun)	1400	28.9	80		SSW	3	0.213	24	28	10.0	21.6
(cont.)	1500	27.2	100		SE	3	0.253	37	27	9.9	22.0
	1600	26.7	100		SE	2	0.248	35	25	9.9	19.6
	1700	26.7	100		S	3	0.218	25	24.5	9.9	14.1
	1800	25.6	100		SE	3	0.271	43	23.5	9.8	11.6
	2000	24.4	Dusk		SE	2	0.233	30	21	9.9	4.9
	2200	21.7	Dark		E	3	0.240	32	20	9.6	0.2
	2400	21.1	"		SW	3	0.198	20	19	9.6	0.0
8/8/55	0200	21.1	"		SE	3	0.144	9	18	9.7	0.4
(Mon)	0400	21.1	Dawn		SE	2	0.114	5	18	9.7	0.1
	0500	20.00	98		SE	2	0.120	6	18	9.7	0.1
	0600	17.2	98		ESE	2	0.214	24	18	9.5	1.1
	0700	17.8	95		ESE	3	0.230	29	19	9.4	2.7
	0800	20.0	80		ESE	3	0.234	24	19	9.4	7.2
	0900	22.2	40		E	4	0.245	34	23	9.7	10.8
	1000	26.7	50		ESE	4	0.232	29	27	9.7	14.7
	1100	29.4	10		SSW	3	0.235	30	29	9.8	21.2
	1200	31.1	10		SW	1	0.290	52	30	10.0	25.9
	1300	31.7	10		SSW	2	0.242	33	30	10.0	25.6
	1400	32.2	15		SSW	3	0.226	28	28	10.0	15.0
	1500	34.4	10		W	2	0.250	36	28.5	10.0	24.6

FIELD OBSERVATIONS
Summer 1955 (Continued)

WALL, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Head on 90°Weir (ft.)	Raw Sewage Flow (gpm)	Pond Temp. (°C)	Pond pH	Pond D. O. (ppm)
8/8/55	1600	34.4	10		N	3	0.236	31	30	10.1	28.3
(Mon)	1700	31.1	5		NE	4	0.237	31	28.5	9.9	24.8
(cont.)	1800	28.9	2		E	4	0.401	116	27	9.9	18.2
	2000	23.3	Dark		E	3	0.276	46	24	9.7	5.7
	2200	19.4	"		E	2	0.250	36	22	9.9	3.8
	2400	19.4	"		Calm	0	0.186	17	22	9.9	2.9
8/9/55	0200	22.2	"		W**	2	0.125	6	22	10.0	0.8
(Tues)	0400	21.1	Dawn		W	1	0.155	11	23	10.0	0.0
	0500	21.1	85		SSW	1	0.159	12	23	10.0	0.0
	0600	21.1	25		W	2	0.202	21	22	9.9	0.0
	0700	27.8	15		N	3	0.253	37	23	9.7	6.8
	Max.	34,4	---		---	4	---	116	33	10.1	28.3
	Min.	12.2	---		---	0	---	4	16	9.4	0.0
	Ave.	23.7	---		---	---	26.8gpm-38,500gpd		23.4	9.8	9.7
Ave.8/6-7(0800-0700)		22.4	---		---	---	22.6gpm-32,400gpd		23.9	---	10.4
Ave.8/7-8(0800-0700)		23.4	---		---	---	25.5gpm-36,700gpd		21.4	9.7	7.8
Ave.8/8-9(0800-0700)		25.3	---		---	---	32.4gpm-46,500gpd		24.8	9.9	10.8

* NW corner, 10' from shore.
** Rain at 0300

FIELD OBSERVATIONS
Fall 1955

WALL, SOUTH DAKOTA

Date	Time	Raw Sewage Gage(90°) Feet	Flow (gpm)
11/10	1700	0.14	8.5
	1800	0.17	14
	1900	0.19	18
	2000	0.20	21
	2100	0.18	16
	2300	0.17	14
11/11	0300	0.11	5
	0600	0.13	7
	0700	0.14	8.5
	0800	0.15	10
	0900	0.16	12
	1000	0.19	18
	1100	0.19	18
	1200	0.20	21
	1300	0.19	18
	1400	0.18	16
	1600	0.17	14
Max.			21
Min.			5
Ave.		12.5 (17,900 gpd)	

FIELD OBSERVATIONS
Spring 1955

LEMMON, SOUTH DAKOTA

Date	Time	Weather				Raw Sewage		Pond (at Effluent)*		
		Air Temp. (°C)	Sky (% cover)	Wind Direc.	Velo. Beaufort	Head over 90° Weir (Feet)	Flow (gpm)	Temp. (°C)	pH	D.O. ppm
5/4/55	1000	---	25	---	6	0.35	83	---	---	---
	1200	---	25	---	6	0.36	88	---	---	---
	1400	---	25	---	6	0.36	88	---	---	---
	1600	19.4	25	---	6	0.36	88	---	---	---
	1800	11.1	25	---	6	0.33	71	---	---	---
	2000	4.4	Dark	W	2	0.35	83	---	---	---
	2200	2.2	"	WNW	2	0.34	77	---	---	---
	2400	0.6	"	W	2	0.30	56	---	---	---
5/5/55	0200	1.1	"	SW	2	0.25	36	---	---	---
	0400	1.1	Dawn	W	3	0.21	23	---	---	---
	0600	8.9	25	W	3	0.21	23	---	---	---
	0800	15.6	20	S	4	0.24	32	---	---	11.9
	1000	18.9	10	S	4	0.39	108	13	9.1	14.6
	1200	24.4	20	S	5	0.385	105	14	9.3	15.3
	1400	27.8	20	SW	5	0.265	91	15	9.3	15.6
	1600	26.1	10	SW	5	0.350	83	14½	9.3	16.9
	1800	21.7	10	W	2	0.33	71	14½	9.2	16.5
	2000	6.7	Dark	W	2	0.34	77	14	9.1	16.1
	2200	6.7	"	SW	2	0.32	66	13	9.1	15.6
	2400	10.0	"	S	3	0.30	56	13	9.0	14.8

FIELD OBSERVATIONS
Spring 1955

LEMMON, SOUTH DAKOTA (Continued)

		Weather				Raw Sewage		Pond (at Effluent)*		
Date	Time	Air Temp. (°C)	Sky (% cover)	Wind Direc.	Velo. Beaufort	Head over 90° Weir (Feet)	Flow (gpm)	Temp. (°C)	pH	D.O. ppm
5/6/55	0200	7.8	Dark	S	3	0.25	36	12	9.2	12.3
	0400	11.1	Dawn	N	3	0.21	23	12	9.1	12.2
	0600	12.8	50	NW	4	0.23	29	12	9.2	12.8
	0800	14.4	70	NW	4	0.25	36	13	9.3	11.9
Max.		27.8	---	---	6	---	108	15	9.3	16.9
Min.		1.1	---	---	2	---	23	12	9.0	11.9
Ave.5/4 - 6		---	---	---	---	63.7 (91,800 gpd)		---	---	---
Ave.5/4-5	--	---	---	---	---	62.5gpm(90,000gpd)		---	---	---
Ave.5/5-6		15.7	---	---	---	65.0gpm(93,600gpd)		13.4	9.2	14.6

* (Effluent flow not measured)

FIELD OBSERVATIONS
Summer 1955

LEMMON, SOUTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Flows Raw (gpm)	Flows Effluent (gpm)	Pond Temp. (°C)	Effluent pH	Effluent D.O. ppm
8/10/55	1000	26.7	5		S	4	242	---	23	9.50	9.0
	1100	28.3	5		S	4	146	16	24	9.35	8.9
	1200	29.4	5		SW	4	122	14	24	9.25	9.8
	1300	28.9	30		S	2	130	14	24.5		9.8
	1400	28.9	50		SW	4	130	12	25	9.45	11.2
	1500	28.9	60		SE	4	127	12	25	9.45	13.2
	1600	29.4	50		SSE	4	130	12	24.5	9.5	13.1
	1700	28.3	50		SSE	2	108	12	25	9.4	13.0
	1800	26.7	20		SE	3	130	12	24	9.45	13.5
	2000	18.9	Dark		SE	2	130	12	23	9.5	10.3
	2200	17.2	"		SE	2	130	12	22	9.4	9.2
	2400	17.8	"		SE	3	71	12	21.5	9.45	8.1
8/11/55	0200	13.3	"		SSE	2	48	11	21	9.45	5.6
	0400	14.4	Dawn		S	1	43	10	21	9.4	4.6
	0500	13.3	40		S	1	43	10	21.5	9.35	4.7
	0600	17.2	80		S	3	43	10	21.5	9.3	5.0
	0700	18.9	60		S	3	56	10	22	9.35	6.4
	0800	21.1	60		S	3	77	10	22	9.30	6.2
	0900	24.4	50		S	3	146	10	23	9.20	6.2
	1000	24.4	25		SSW	2	146	10	23	9.25	6.3
	1100	29.4	25		SSW	1	154	10	23	9.25	8.8
	1200	32.2	20		SE	1	137	10	25	9.3	12.1
	1300	30.6	10		WSW	2	137	12	27	9.4	19.0
	1400	29.4	5		SE	2	154	12	27	9.5	25.8
	1500	31.1	[illegible]		NW	2	130	10	29	9.55	34.4

FIELD OBSERVATIONS
Summer 1955

LEMMON, SOUTH DAKOTA (Continued)

Date	Time	Weather: Air Temp. (°C)	Weather: Sky (%cover)	Weather: Light Intensity	Wind: Direc.	Wind: Velo. Beaufort	Flows: Raw (gpm)	Flows: Effluent (gpm)	Pond Effluent: Temp. (°C)	pH	D.O. ppm
8/11/55	1600	31.7	0		SW	1	122	10	29.5	9.60	33.9
(cont.)	1700	32.8	0		Calm	0	122	10	30	9.75	42.0
	1800	30.0	0		S	2	122	12	29	9.70	28.5
	1900	24.4	2		SSW	3	108	10	26.5	9.40	19.9
	2000	24.4	Dark		S	3	115	10	24	9.5	14.2
	2200	20.0	"		SW	3	115	10	23.5	9.5	15.6
	2400	16.7	"		SSW	3	77	10	22	9.4	12.2
8/12/55	0200	15.0	"		S	3	52	10	21	9.4	13.6
	0400	13.9	Dawn		Calm	0	40	8	21	9.35	10.5
	0500	15.6	0		SSE	2	40	8	21	9.35	10.5
	0600	17.2	0		S	3	43	8	22	9.30	3.7
	0700	20.6	0		S	4	56	8	22	9.35	2.1
	0800	17.8	0		S	3	71	8	23	9.45	4.0
	0900	26.7	0		S	3	108	8	24	9.40	9.7
	1000	28.3	0		SSE	4	200	7	24	9.40	10.0
	1100	31.1	0		S	4	172	8	25	9.40	13.0
	1200	33.3	0		SW	4	146	8	26	9.6	12.9
	1300	32.8	0		SE	5	137	10	25	9.4	9.8
	1400	33.3	0		SW	4	146	10	26	9.6	11.8
	1500	33.3	0		S	4	146	8	26	9.4	11.0
	1600	32.8	0		S	4	146	8	25	9.4	10.4
	1700	31.7	2		SE	4	122	8	25	9.55	10.6
	1800	30.0	5		S	2	108	7	24	9.6	9.5
	1900	23.9	5		SE	2	130	7	23	9.55	9.0

FIELD OBSERVATIONS
Summer 1955

LEMMON, SOUTH DAKOTA (Continued)

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Light Intensity	Wind Direc.	Wind Velo. Beaufort	Flows Raw (gpm)	Flows Effluent (gpm)	Pond Temp. (°C)	Effluent pH	Effluent D.O. ppm
8/12/55	2000	21.1	Dark		Calm	0	130	7	23	9.50	8.0
(cont.)	2200	23.3	"		SSE	3	102	7	23	9.45	7.6
	2400	21.7	"		SSE	3	88	7	24	9.5	4.6
8/13/55	0200	20.0	"		SE	4	56	7	23	9.5	4.5
	0400	19.4	Dawn		SE	3	48	7	23	9.4	4.0
	0500	---	---		---	---	---	---	---	---	---
	0630	21.1	5		S	5	48	7	23	9.45	2.4
Max. 8/10-13		33.3	---		---	5	242	16	30	9.75	42.0
Min. "		13.3	---		---	0	40	7	21	9.20	2.1
Ave. "		23.4	---		---	101.4(145,800gpd)		10.1(14,590gpd)	23.3	9.42	11.0
Ave.8/10-11		21.5	---		---	91.7(131,900gpd)		11.9(17,200gpd)	21.8	9.40	8.9
Ave. 8/11-12		23.2	---		---	103.4(149,000gpd)		10.4(14,950gpd)	24.2	9.43	16.2
Ave.8/12-13		25.5	---		---	109.0(156,500gpd)		8.1(11,620gpd)	23.9	9.47	7.8

FIELD OBSERVATIONS
Fall 1955

LEMMON, SOUTH DAKOTA

Date	Time	Raw Sewage Gage (Ft)	Raw Sewage Flow (gpm)
11/8	0720	0.285	50
(Tues.)	0800	0.31	61
	0900	0.38	102
	1000	0.43	137
	1100	0.44	146
	1200	0.43	137
	1320	0.43	137
	1400	0.43	137
	1500	0.40	115
	1600	0.39	108
	1700	0.39	108
	1800	0.38	102
	1900	0.40	115
	2000	0.41	122
	2130	0.40	115
11/9	0130	0.33	71
(Wed.)	0430	0.29	52
	0630	0.29	52
Max.		---	146
Min.		---	50
Ave.		96.2 (138,800 gpd)	

FIELD OBSERVATIONS
Spring 1955

MADDOCK, NORTH DAKOTA

Date	Time	Weather: Air Temp. (°C)	Weather: Sky (% Cover)	Weather: Wind Direc.	Weather: Wind Velo. (Beaufort Scale)	Raw Sewage: Head over 90° Weir (Feet)	Raw Sewage: Flow (gpm)	Pond (Cell #1)*: Temp. (°C)	Pond (Cell #1)*: pH	Pond (Cell #1)*: D. O. ppm
5/8/55 (Sun)	0800	---	---	---		---	---	9	9.0	15.8
	1000	8.3	50	SE	6	---	---	10	9.0	17.9
	1200	13.3	30	SE	6	---	---	10	9.0	18.2
	1400	15.0	Dust haze	SE	6	0.22	26	10	9.0	17.1
	1600	15.0	100	SE	6	0.18	16	11	8.9	15.8
	1800	15.0	100	SSE	6	0.22	26	10	8.9	14.2
	2000	15.6	100	SSE	6	0.21	23	10	8.9	12.6
	2200	10.0	Dark	SSE	6	0.22	26	10	8.9	11.3
	2400	8.9	Rain	SE	5	0.21	23	10	8.9	11.4
5/9/55 (Mon)	0200	8.9	Dark	SE	4	0.21	23	10	8.9	11.2
	0400	6.7	Dark	SSW	4	0.18	16	10	9.0	9.8
	0600	6.1	Br. Sunrise	SSW	3	0.19	18	9	8.9	10.0
	0800	8.9	50	W	4	0.26	40	10	8.9	13.9
	1000	11.7	20	WNW	5	0.33	71	10	8.9	14.1
	1200	15.0	20	WNW	6	0.43	137	11	9.0	15.0
	1400	14.4	Br. sun 60	NW	6	0.32	66	12½	9.1	15.9
	1600	15.0	" " 40	NW	6	0.35	83	12½	9.1	15.4
	1800	13.3	40	WNW	5	0.20	21	12	9.0	15.2
	2000	8.3	0	WNW	2	0.20	21	10	9.1	14.8
	2200	5.6	Dark	W	2	0.20	21	10	9.0	13.8
	2400	4.4	"	W	2	0.20	21	10	8.9	11.6

FIELD OBSERVATIONS
Spring 1955 (Continued)

MADDOCK, NORTH DAKOTA

Date	Time	Weather: Air Temp. (°C)	Weather: Sky (% Cover)	Weather: Wind Direc.	Weather: Wind Velo. (Beaufort Scale)	Raw Sewage: Head over 90° Weir (Feet)	Raw Sewage: Flow (gpm)	Pond (Cell #1)*: Temp. (°C)	Pond (Cell #1)*: pH	Pond (Cell #1)*: D. O. ppm
5/10/55 (Tues)	0200	3.3	Dark	W	2	0.18	16	9	9.0	11.4
	0400	---	---	---	---	---	---	---	---	---
	0600	---	---	---	---	0.16	12	10	9.0	12.8
	0800	13.3	15	NNW	2	0.25	36	10	9.2	15.4
	1000	16.1	10	NNW	2	0.30	56	12	9.2	16.2
	1200	18.3	10	---	0	0.39	108	13	9.2	19.9
	1400	18.9	10	NW	3	0.37	95	14	9.2	24.2
	1600	18.3	20	NW	3	0.32	66	14	9.3	19.7
	1820	16.1	25	NW	2	0.22	26	13½	9.3	15.5
	2000	11.1	25	---	0	0.25	36	12	9.3	24.2
	2200	8.9	Dark	S	2	0.24	32	11	9.1	22.1
	2400	5.6	"	S	2	0.20	21	11	9.0	---
5/11/55 (Wed)	0200	5.6	"	S	2	0.19	18	11	8.9	19.3
	0400	10.0	"	---	0	0.13	7	11	8.9	20.8
	0600	10.0	100	SW	3	0.16	12	11	9.0	22.4
Max.(Spring)		18.9	---	---	6		137	14.0	9.3	24.2
Min.(Spring)		3.3	---	---	1		7	9.0	8.9	9.8
Ave.(Spring)		11.3	---	---	---	43.1(61,100gpd)		10.8	9.0	15.9
Ave. 5/8-9		11.0	---	---	---	---		9.9	8.9	13.8
Ave. 5/9-10		10.1	---	---	---	43.5(62,600gpd)		10.6	9.0	13.8
Ave. 5/10-11		12.7	---	---	---	42.7(61,400gpd)		12.0	9.1	20.0

* NE corner, 5 feet off shore.

FIELD OBSERVATIONS
Summer 1955

MADDOCK, NORTH DAKOTA

Date	Time	Air Temp (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Head over 90° weir (feet)	Raw Sewage Flow (gpm)	Pond (Cell #1) * Temp. (°C)	Pond (Cell #1) * pH	Pond (Cell #1) * D. O. (ppm)
8/15/55 (Mon)	0900	20.0	70		---	1	0.28	48	21	8.7	3.0
	1000	21.1	70		---	1	0.29	52	22	8.9	8.8
	1100	21.1	60		NNE	3	0.29	52	23	8.9	6.2
	1200	22.2	40		N	3	0.27	43	24	8.8	7.3
	1300	22.2	20		NNE	2	0.39	108	24	8.85	4.9
	1400	23.3	5		NE	3	0.38	102	26	8.9	8.5
	1500	24.4	1		E	2	0.30	56	26	8.95	10.7
	1600	25.0	0		E	3	0.36	88	27	9.0	13.0
	1700	25.6	0		NE	2	0.24	32	26	8.95	10.9
	1800	25.0	0		N	3	0.22	26	26	9.0	10.6
	1900	22.8	0		N	2	0.22	26	25	9.1	9.5
	2000	18.9	15		NNE	2	0.21	23	22	9.0	2.2
	2200	15.6	Dark		ENE	2	0.21	23	21	8.95	1.5
	2400	12.8	"		NE	1	0.18	16	20	8.95	0.8
8/16/55 (Tues	0200	12.2	.		E	2	0.15	10	20	9.0	0.3
	0400	14.4	90		E	2	0.15	10	21	9.0	0.0
	0600	15.0	95		---	1	0.15	10	20	9.0	0.0
	0700	15.0	100		ESE	4	0.16	12	20	8.95	0.3
	0800	15.6	95		E	5	0.22	26	19½	8.95	0.6
	0900	17.2	95		WSW	2	0.28	48	19½	8.95	0.4
	1000	21.1	60		---	1	0.33	71	21	8.7	0.8
	1100	23.3	70		S	1	0.42	130	21½	8.75	1.4

FIELD OBSERVATIONS
Summer 1955 (Continued)

MADDOCK, NORTH DAKOTA

Date	Time	Weather: Air Temp. (°C)	Weather: Sky (%cover)	Weather: Light Intensity	Wind: Direc.	Wind: Velo. Beaufort	Raw Sewage: Head over 90° Weir (feet)	Raw Sewage: Flow (gpm)	Pond (Cell #1) *: Temp. (°C)	Pond (Cell #1) *: pH	Pond (Cell #1) *: D. O. (ppm)
8/16/55 (Tues) (Cont.)	1200	24.4	80		S	2	0.42	130	22	8.7	1.3
	1300	25.6	30		SW	3	0.40	115	22	8.8	2.1
	1400	27.8	20		S	4	0.42	130	22½	8.85	1.0
	1500	28.3	15		SW	4	0.26	40	23	8.85	0.7
	1600	28.3	10		SW	4	0.35	83	23	8.8	1.1
	1700	28.3	20		SW	4	0.26	40	22	8.85	0.7
	1800	26.7	80		SSW	3	0.21	23	22	8.95	0.5
	1900	24.4	100		E	4	0.22	26	22	8.95	0.2
	2000	23.9	100		E	4	0.215	24	---**	---**	---**
	2200	21.7	Dark		NNE	4	0.215	24	---**	---**	---**
	2400	---**	---**		---**	---**	0.19	18	---**	---**	---**
8/17/55 (Wed)	0200	---**	---**		---**	---**	0.18	16	---**	---**	---**
	0400	---**	---**		---**	---**	0.16	12	---**	---**	---**
	0600	---**	---**		---**	---**	0.155	11	---**	---**	---**
	0700	17.8	0		SW	3	0.16	12	20	8.9	0.5
	0800	18.9	0		SW	3	0.22	26	20	8.7	1.5
	0900	21.1	0		S	3	0.25	36	21	8.7	1.2
	1000	25.0	0		SW	3	0.43	137	22	8.6	3.3
	1100	26.7	0		E	2	0.32	66	24	8.8	5.6
	1200	27.2	0		W	2	0.24	32	25.5	8.8	5.8
	1300	28.9	0		W	1	0.30	56	27	8.9	6.5
	1400	30.6	0		W	1	0.25	36	25.5	8.9	3.0

FIELD OBSERVATIONS
Summer 1955 (Continued)

MADDOCK, NORTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (%cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Head over 90° Weir (feet)	Raw Sewage Flow (gpm)	Pond (Cell #1) * Temp. (°C)	Pond pH	Pond D. O. (ppm)
8/17/55	1500	32.2	0		Calm	1	0.22	26	29	9.0	8.9
(Wed)	1600	33.3	0		E	1	0.36	88	27	9.1	5.0
(Cont.)	1700	35.6	0		Calm	1	0.22	26	30	9.3	14.0
	1800	31.1	40		N	1	0.21	23	30	9.3	15.8
	1900	28.9	40		Calm	1	0.22	26	27	9.05	8.8
	2000	27.8	30	0	"	1	0.22	26	26	9.0	6.3
	2200	22.2	Dark	0	"	1	0.20	21	24.5	9.0	5.3
	2400	20.0	"	0	W	2	0.19	18	24	9.0	4.6
8/18/55	0500	16.1	15	0	Calm	1	0.16	12	22	9.05	3.9
(Thurs)	0600	17.2	0		"	1	0.16	12	22	9.0	3.4
Max		35.6	---		---	5	---	137	30	9.3	15.8
Min 8/15-18		12.2	---		---	1	---	12	19.5	8.6	0.0
Ave.		21.4	---		---	---	38.4(55,200 gpd)		23.5	8.96	5.0
Ave. 8/15-16		18.5	---		---	---	36.4(52,300 gpd)		22.3	8.95	4.4
Ave. 8/16-17		---	---		---	---	45.6(65,600 gpd)		---	---	---
Ave. 8/17-18		24.4	---		---	---	33.3(47,800 gpd)		24.7	8.97	5.7

* 100' North on East dike, 10' off shore line.
** Pond inaccessible due to heavy rain.

FIELD OBSERVATIONS
Fall 1955

MADDOCK, NORTH DAKOTA

Date	Time	Weather: Air Temp. (°C)	Weather: Sky (% cover)	Weather: Light Intensity	Wind: Direc.	Wind: Velo. Beaufort	Raw Sewage: Head over 90° Weir (feet)	Raw Sewage: Flow (gpm)	Pond (Cell #1) *: Temp. (°C)	Pond (Cell #1) *: pH	Pond (Cell #1) *: D. O. (ppm)
11/1/55	0700	---	---	---	---	---	0.15	10	---	---	---
(Tues)	0800	---	---	---	---	---	0.20	21	---	---	---
	0900	-2.2	100	---	NW	6	0.26	40	2	8.18	7.8
	1000	-3.3	90	350	WNW	6	0.33	71	---	---	---
	1100	-2.2	80	700	WNW	6	0.32	66	---	---	---
	1200	---	---	---	---	6	0.26	40	---	---	---
	1300	-3.9	95	1600	W	6	0.32	66	---	---	---
	1400	---	---	---	---	6	0.30	56	---	---	---
	1500	-2.8	100	---	W	6	0.25	36	---	---	---
	1600	-3.9	100	---	W	6	0.29	52	2	8.35	9.4
	1700	-5.6	100	100	W	6	0.27	43	---	---	---
	1800	-6.1	100	---	WNW	6	0.22	26	---	---	---
	1910	---	---	---	---	---	0.23	29	---	---	---
	2000	---	---	---	---	---	0.20	21	---	---	---
	2100	---	---	---	---	---	0.22	26	---	---	---
	2400	---	---	---	---	---	0.18	16	---	---	---
11/2/55	0300	---	---	---	---	---	0.15	10	---	---	---
(Wed)	0600	---	---	---	---	---	0.14	8	---	---	---
	0715	-8.3		13	WNW	6	---	---	---**	---	---
	Max.	-2.2					---	81			
	Min.	-8.3					---	8			
	Ave.	---					30.1 (43,300 gpd)				

* 100' North on East dike, 10' off shore.
Strong winds, ground blizzard and high waves all day.

** All ponds 1/2 - 3/4 covered with ice.

FIELD OBSERVATIONS
Spring 1955

WISHEK, NORTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (% cover)	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Flow** (gpm)	Pond (East dike)* Temp. (°C)	Pond (East dike)* pEpH	Pond (East dike)* D. O. (ppm)
5/11/55	1600	24.4	5(Brt.Sun)	W	3	43	23	9.5	34.2
(Wed)	1800	23.3	5 " "	W	3	44	21	9.5	37.8
	2000	15.0	Dusk	E	3	18	17	9.1	26.6
	2200	11.1	Dark	S	2	14	15	8.9	21.3
	2400	7.8	"	S	2	17	14	9.1	21.4
5/12/55	0200	5.6	"	SE	2	1	13	9.1	19.6
(Thurs)	0400	8.9	Dawn	SE	4	1	12	9.1	16.2
	0600	17.8	50	S	2	1	13	9.1	14.8
	0800	17.2	95	W	4	16	14	9.1	14.2
	1000	21.7	10	WSW	3	104	17	9.1	24.0
	1200	25.0	10	Calm	0	16	22	9.2	31.2
	1400	27.2	10	W	4	30	27	9.6	32.2
	1600	28.3	40	W	3	9	28	9.7	36.9
	1800	26.1	20	W	4	29	26	9.7	33.0
	2000	17.8	Dusk	S	2	10	18	9.1	17.7
	2200	18.9	Dark	S	1	11	18	9.1	20.4
	2400	11.1	"	S	1	12	15	9.1	14.2
5/13/55	0200	8.9	"	SE	2	1	14	9.1	11.5
(Fri)	0400	11.1	Dawn	SE	2	1	15	9.1	7.8
	0600	17.8	20	SE	3	1	15	9.1	13.9
	0800	17.8	50	S	4	24	16	8.9	13.8
	1000	20.6	80	SE	5	49	17	8.9	16.6
	1200	26.1	10	SE	5	19	19	9.1	19.4
	1400	28.3	Dust Haze	SE	6	25	20	9.1	20.5

FIELD OBSERVATIONS
Spring 1955 (Continued)

WISHEK, NORTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (% cover)	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Flow** (gpm)	Pond (East dike)* Temp. (°C)	pH	D. O. (ppm)
5/13/55	1600	28.3	Dust Haze	SE	6	18	20	9.1	21.3
(Fri)	1800	25.0	" "	S	5	30	20	9.1	19.2
(Cont.)	2000	20.6	Dusk	S	5	29	18	9.1	13.9
	2200	18.9	Dark	S	5	18	17	9.1	10.8
	2400	16.1	"	S	5	7	16	9.1	9.2
5/14/55	0200	14.4	"	S	5	1	16	9.1	7.4
(Sat)	0400	13.3	Dawn	S	1	1	14	9.1	4.8
	0600	13.3	100	S	4	2	15	8.9	7.1
Max. (5/11-14)		28.3	---	---	6	104	28	9.7	37.8
Min. (5/11-14		5.6	---	---	0	1	12	8.9	4.8
Ave. (5/12-14)		19.7	---	---	19.3 (27,800gpd)		18.2	9.15	17.6
Ave. (5/12-13)		19.2	---	---	20 (28,800 gpd)		19.1	9.25	21.42
Ave. (5/13-14)		20.2	---	---	18.6 (26,800 gpd)		17.3	9.05	13.67

* 10 feet off shore, in line with North side of island.

** Raw sewage flow measured by area-velocity method.

FIELD OBSERVATIONS
Summer 1955

WISHEK, NORTH DAKOTA

Date	Time	Weather: Air Temp. (°C)	Weather: Sky (% cover)	Weather: Light Intensity	Wind: Direc.	Wind: Velo. Beaufort	Raw Sewage: Head on 90° Weir (feet)	Raw Sewage: Flow (gpm)	Pond (E dike*): Temp. (°C)	Pond (E dike*): pH	Pond (E dike*): D. O. (ppm)
8/18/55	1600	35.6	5		E	2	---	---	32.5	9.5	32.0
(Thurs)	1700	34.4	5		E	3	---	---	27.0	8.9	13.8
	1800	33.3	5		E	2	---	---	27.0	8.7	9.4
	2100	20.0	---		E	2	0.296	54	27.0	9.2	26.1
8/19/55	0100	17.8	0		SE	2	0.246	34	24.8	---	10.6
(Fri)	0600	17.2	70		ESE	2	0.184	15	23.0	8.4	0.5
	0700	23.3	70		SE	2	0.210	23	23.0	8.8	7.8
	0800	26.7	90		SSE	3	0.272	44	24.0	8.7	1.1
	0900	26.7	80		SE	3	0.217	64	24.0	8.8	6.1
	1000	27.8	100		SW	4	0.336	75	24.0	8.8	5.9
	1100	20.0	Heavy rain		SSW	4	0.359	88	23.0	8.4	3.5
	1300	20.0	" "		SW	3	0.335	74	23.0	8.4	3.5
	1400	22.2	100		S	1	0.336	75	23.0	8.6	4.4
	1500	22.8	100		S	3	0.321	66	24.0	8.7	8.8
	1600	22.2	100		S	3	0.304	58	23.0	8.7	8.8
	1700	21.7	95		S	3	0.301	56	23.0	8.7	7.4
	1815	23.9	80		SW	3	0.320	66	23.0	8.7	5.7
	1900	22.2	80		SW	3	0.310	61	23.0	8.6	2.9
	2000	21.1	90		SW	1	0.320	66	22.5	8.5	0.8
	2200	17.8	Dark		Calm	0	0.288	51	22.0	8.6	0.2
8/20/55	2400	---	"		---	---	0.271	43	---	---	---
(Sat)	0200	---	"		---	---	0.245	33	---	---	---
	0500	15.0	0		NE	1	0.196	21	21.0	8.5	0.0

FIELD OBSERVATIONS
Summer 1955 (Continued)

WISHEK, NORTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (% cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Head on 90° Weir (feet)	Raw Sewage Flow (gpm)	Pond (E dike*) Temp. (°C)	Pond pH	Pond D. O. (ppm)
8/20/55	0600	15.6	0		NE	1	0.194	19	21.0	8.5	0.0
(Sat)	0700	21.7	0		Calm	0	0		21.5	8.5	0.2
(Cont.)	0800	23.3	0		SW	2	0.275	45	22.0	8.5	3.4
	0900	23.9	0		W	3	0.310	61	23.0	8.6	8.1
	1000	25.6	0		W	3	0.330	71	24.0	8.6	13.9
	1100	---	0		W	3	0.352	84	26.0	8.8	20.1
	1200	---	0		SW	4	0.330	71	26.0	9.0	17.9
	1300	---	0		W	3	0.337	75	26.0	9.2	19.9
	1400	32.8	5		W	3	0.327	69	28.0	9.3	25.6
	1500	33.3	0		W	4	0.336	75	27.0	9.4	20.0
	1600	33.9	0		SW	3	0.355	85	26.5	9.3	23.0
	1700	33.3	0		W	2	0.319	66	26.5	9.3	23.4
	1830	31.1	5		W	2	0.323	67	27.0	9.2	18.5
	1900	---	---		---	---	0.353	84	---	---	---
	2000	20.0	0		Calm	0	0.407	120	25.5	9.0	13.7
8/21/55	2200	17.8	Dark		"	0	0.337	75	25.0	8.9	9.4
(Sun)	2400	17.8	"		"	0	0.323	67	23.0	8.8	5.0
	0200	17.8	"		NNE	3	0.282	49	23.0	9.0	3.4
	0540	15.6	100		NW	4	0.250	36	21.5	8.7	2.4
	0630	---	Light rain				0.236	31	---	---	---

FIELD OBSERVATIONS
Summer 1957 (Continued)

WISHEK, NORTH DAKOTA

Date	Time	Air Temp. (°C)	Weather Sky (% cover)	Weather Light Intensity	Wind Direc.	Wind Velo. Beaufort	Raw Sewage Head on 90° Weir (feet)	Raw Sewage Flow (gpm)	Pond (E dike*) Temp. (°C)	Pond pH	Pond D. O. (ppm)
Max.	(8/18-21)	35.6	---		---	4		120	32.5	9.5	32.0
Min.	(")	15.0	---		---	0		15	21.0	8.4	0.0
Ave.	(8/19-21)	21.9	---		---	---		60.2 (86,600gpd)	23.4	8.75	7.22
Ave.	(8/19-20)	20.3	---		---	---		54.3 (78,100 gpd)	22.5	8.6	2.96
Ave.	(8/20-21)	23.5	---		---	---		66.2 (95,100 gpd)	24.4	8.9	11.49

* Ten feet off shore.

APPENDIX C

Laboratory Analyses

LABORATORY ANALYSES
Seasonal Summary 1955

KADOKA, SOUTH DAKOTA

STA.	SEASON	DAYS SAMPLED /Depth	TEMP. °C	D.O. ppm	D.O. %Sat.	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	Winter	3	-	7.5		560	8.9	17.1	608	126	4.9	76	0.054	0.20	134	105	27	970	1030	23,700
Raw	Spring	1	-	-	-	422	7.6	0	524	196	0.4	130	0.000	0.00	87.4	97	0	552	300	43,000
	Summer	3	-	0.0	0	463	7.0	0	466	99	25.0	41.8	0.008				38	533	383	101,000
	Fall	1	-	0.0	0	256	7.5	0	560	136	0.0	-	-				-	-	320	46,000
																				Max. Mi...
	Winter	3/2.5'	-	0.0	0	62	8.4	17.3	791	215	35.3	29.0	0.000	0.22	39.7	53	28	240	56	2400 - 110
1-u	Spring	3/0.5'	14	0.6	0	40	8.0	0	683	170	1.2	18.5	0.000	0.02	22.7	55	2.0	215	48	750 - 240
	Summer	3/0.5'	27	0.0	0	33	9.0	122	646	158	20.0	1.6	0.008				5.0	215	140	430 - 110
	Fall	1/0.5'	3	0.0	0	31	8.4	65	925	182	1.5	3.2	-				-	-	132	930
	Winter	3/5.0'	-	0.0	0	70	8.4	19.0	808	218	44.2	30.6	0.000	0.16	40.1	55	28	253	84	1100 - 110
1-L	Spring	3/3.0'	14	0.0	0	41	7.9	0.0	678	152	-	21.7	0.000	-	31.5	52	3.5	210	85	460 - 230
	Summer	3/3.0'	26	0.0	0	34	8.8	87	625	157	0.3	2.1	0.004				7.0	203	151	110 - 43
	Fall	1/3.0'	3	0.0	0	23	8.4	65	930	185	1.5	3.5	-				-	-	156	930
	Winter	3/2.5'	-	0.0	0	38	8.4	24.4	788	219	36.6	26.3	0.000	0.19	31.9	50	28	200	66	930 - 110
2-u	Spring	3/0.5'	14	0.1	0	41	7.9	0	679	158	0.2	18.5	0.000	0.02	26.3	55	2.5	243	71	230 - 43
	Summer	3/0.5'	27	0.0	0	34	8.9	136	620	165	0.04	2.1	0.003				9.0	189	151	460 - 46
	Fall	1/0.5'	3	0.0	0	26	8.5	65	930	182	1.0	3.5	-					-	120	930
	Winter	3/5.0'	-	0.0	0	45	8.5	26.0	787	219	36.6	25.6	0.000	0.12	33.1	49	27	213	59	1100 - 430
2-L	Spring	3/5.0'	14	0.0	0	39	8.0	0	680	161	0.9	20.0	0.000	-	24.8	55	3.0	239	90	240 - 230
	Summer	3/5.0'	24	0.0	0	120	7.6	0	918	140	100	8.3	0.005				19.0	243	85	460 - 4
	Fall	1/5.0'	3	0.0	0	50	8.5	70	935	176	1.5	3.7	-				-	-	152	390

LABORATORY ANALYSES
Seasonal Summary 1955 (continued)

KADOKA, SOUTH DAKOTA

STA.	SEASON	DAYS SAMPLED /Depth	TEMP. °C	D.O. ppm	D.O. %Sat.	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATES Tot. ppm	PHOSPHATES Ortho- ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
																				Max. Min.
	Winter	3/3.0'	-	0.0	0	30	8.5	33.6	791	217	36.0	21.8	0.000	0.16	28.5	41	28	200	61	15 - 3.6
3-u	Spring	3/0.5'	13	0.0	0	39	8.0	0	681	161	1.4	20.7	0.000	-	26.9	56	1.5	217	64	240 - 230
	Summer	3/0.5'	24	0.0	0	23	8.8	129	635	161	0.2	2.4	0.002				7.0	195	129	240 - 46
	Fall	1/0.5'	3	0.0	0	30	8.4	65	950	179	1.5	3.6	-				-	-	140	930
	Winter	3/7.0'	-	0.0	0	36	8.4	30.7	800	217	42.8	21.8	0.000	0.13	28.8	42	28	197	69	240 - 2
3-L	Spring	3/5.0'	14	0.0	0	33	7.9	0	680	155	24.2	21.3	0.000	-	25.1	50	3.5	216	77	460 - 430
	Summer	3/5.0'	25	0.0	0	33	7.6	0	784	150	128	8.1	0.001				20	219	84	240 - 9
	Fall	1/5.0'	3	0.0	0	32	8.4	70	945	176	1.4	3.2	-				-	-	130	430
	Winter	3	-	0.0	0	22	8.4	27.1	776	219	22.1	21.2	0.000	0.13	38.3	44	26	220	124	24 - 1.1
Effl.	Spring	3	13	4.5	46	51	8.2	0	687	149	0.8	10.8	0.000	0.02	34.2	58	4.0	243	107	230 - 120
	Summer	3	26	0.0	0	60	8.8	104	561	161	16.0	2.4	0.002				8.0	146	119	240 - 43
	Fall	1	-	0.0	0	35	8.1	0	932	182	0.0	-	-				-	-	108	430

LABORATORY ANALYSES
Winter (Jan.) 1955

KADOKA, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE Jan. 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(3) ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE (5) ppm	TOTAL NITROGEN (5) ppm	PHOSPHATE Tot. (5) ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	22	1120	-	7.7	68	618	8.0	0	680	141	-	120	0.001	0.24	175	111	18	800	1450	11000
Raw	24	1225	-	7.3	65	338	9.0	32.0	536	115	5.4	52	0.162	0.21	82.6	96	22	500	490	11000
	25	1040	8	-	-	722	8.7	19.2	608	123	4.4	57	0.000	0.16	143	108	42	1600	1150	110000
	Ave.	-	8	7.5	65	560	8.9	17.1	608	126	4.9	76	0.054	0.20	134	105	27	970	1030	23700(6)
	22	1000	0	0.0	0	57.4	8.3	6.8	793	212	22.4	24.0	0.000	0.30	37.6	49	26	230	52	110
1-u	24	1200	0	0.0	0	66.1	8.4	13.2	792	215	38.9	35.0	0.000	0.20	39.4	58	31	270	60	460
	25	1030	2	0.0	0	63.7	8.4	32.0	788	218	44.7	28.0	0.000	0.16	42.0	51	26	220	56	2400
	Ave.	-	0	0.0	0	62.4	8.4	17.3	791	215	35.3	29.0	0.000	0.22	39.7	53	28	240	56	
	22	1010	0	0.0	0	57.9	8.2	0	789	218	30.1	24.0	0	0.14	37.2	54	25	[illegible]	44	110
1-L	24	1210	2	0.0	0	87.0	8.5	24.0	842	220	-	41.2	0	0.19	47.3	58	30	360	160	1100
	25	1035	0	0.0		65.0	8.4	32.0	792	217	58.4	26.5	0	0.16	35.8	54	28	220	48	430
	Ave.	-	0	0.0	0	70.0	8.4	19.0	808	218	44.2	30.6	0	0.16	40.1	55	28	253	84	
	22	1020	0	0.0	0	36.4	8.3	14.0	791	224	25.3	25.0	0	0.17	30.0	53	22	200	52	110
2-u	24	1140	0	0.0	0	40.0	8.5	34.8	786	215	39.9	28.8	0	0.21	33.8	47	31	200	80	460
	25	1015	0	0.0	0	-	8.4	-	-	-	44.7	25.0	0	-	-	-	30	-	-	930
	Ave.	-	0	0.0	0	38.2	8.4	24.4	788	219	36.6	26.3	0	0.19	31.9	50	28	200	66	
	22	1030	0	0.0	0	36.6	8.3	9.6	776	218	16.5	25.0	0	0.09	31.5	42	18	220	68	-
2-L	24	1150	2	0.0	0	47.5	8.5	35.6	791	220	49.6	28.8	0	0.16	33.6	51	31	220	44	1100
	25	1020	1	0.0	0	49.9	8.5	32.4	795	218	43.8	23.0	0	0.10	34.2	54	31	200	64	430
	Ave.	-	1	0.0	0	45.0	8.5	26.0	787	218	36.6	25.6	0	0.12	33.1	49	27	213	59	

LABORATORY ANALYSES
Winter (Jan.) 1955 (continued)

KADOKA, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE Jan. 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(3) ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE (5) ppm	TOTAL NITROGEN (5) ppm	PHOSPHATE Tot. (5) ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	22	1040	0	0.0	0	26.4	8.3	14.0	791	218	24.3	22.0	0	0.16	28.5	41	24	190	56	15
3-u	24	1040	1	0.0	0	25.6	8.5	45.6	788	216	43.8	22.5	0	0.13	27.4	43	30	210	68	43
	25	1010	0	0.0	0	38.1	8.6	41.2	795	216	39.9	21.0	0	0.20	29.7	39	30	200	60	3.6
	Ave.	-	0	0.0	0	30.0	8.5	33.6	791	217	36.0	21.8	0	0.16	28.5	41	28	200	61	
	22	1050	0	0.0	0	38.9	8.3	22.0	788	218	34.0	22.0	0	0.14	27.9	45	22	240	68	2.0
3-L	24	1110	3	0.0	0	33.5	8.5	44.0	809	218	47.6	22.5	0	0.16	27.7	40	30	150	72	240
	25	1010	2	0.0	0	35.0	8.3	29.2	801	216	46.7	21.0	0	0.10	30.7	39	31	200	68	9.1
	Ave.	-	2	0.0	0	35.8	8.4	30.7	800	217	42.8	21.8	0	0.13	28.8	41	28	197	69	
	22	1100	0	0.0	0	25.8	8.3	14.0	780	214	15.6	22.0	0	0.09	30.2	41	22	200	184	1.1
Effluent	24	1130	0	0.0	0	(4)18.4	8.5	35.2	767	223	25.3	22.5	0	0.16	56.0	47	25	130	84	24.0
	25	0955	0	0.0	0	23.0	8.4	32.0	781	219	25.3	19.0	0	0.13	28.6	45	31	330	104	11.0
	Ave.	-	0	0.0	0	22.4	8.4	27.1	776	219	22.1	21.2	0	0.13	38.3	44	26	220	124	

REMARKS:

(1) Location
#1 -- 100 feet North of inlet
#2 -- Center of pond at bend; 325 ft. from inlet
#3 -- Center of pond 100 ft. from outlet, 500 ft. from inlet
Effluent -- at outlet structure; 650 ft. from inlet

(2) Depth
#1 -- Total: 6'-2"; Ice: 10"; Sample: Upper - 2.5', Lower - 5.0'.
#2 -- " 6'-5"; " : 11"; " : " - 2.5', " - 5.0'.
#3 -- " 8'-0"; " : 11"; " : " - 3.0', " - 7.0'.

(3) Samples collected 1/25 were transported from Philip to Lemmon during incubation.

(4) BOD of same sample after filtering through #12 Whatman filter paper: 4.4 ppm.

(5) Analyses made in Cincinnati.

(6) Geometric Mean.

LABORATORY ANALYSES
Spring, 1955

KADOKA, SOUTH DAKOTA

STATION Location (1) Depth(2)	DATE April 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN (4) ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Raw	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	26-27	Comp(3)	-	-	-	422	7.6	0	524	196	0.4	130	0.000	0.00	87.4	97.0	0	552	300	43,000
	Ave.		-	-	-															
	25	1025	14	0.0	0	48	7.7	0	681	170	1.2	18.5	0.000	-	-	-	2.0	160	20	-
1-u	26	0810	14	0.0	0	34	8.0	0	688	-	-	-	-	0.02	22.7	55.0	-	246	-	240
	27	0910	15	1.7	18	37	8.3	0	680	-	-	-	-	-	-	-	-	240	76	750
	Ave.	-	14	0.6		40	8.0	0	683	170	1.2	18.5	0.000	0.02	22.7	55.0	2.0	215	48	
	25	1045	14	0.0	0	36	7.6	0	677	152	-	21.7	0.000	-	-	-	3.5	184	120	-
1-L	26	0810	14	0.0	0	38	7.9	0	692	-	-	-	-	-	31.5	52.0	-	220	60	460
	27	0910	15	0.0	0	48	8.2	0	664	-	-	-	-	-	-	-	-	226	76	230
	Ave.	-	14	0.0	0	41	7.9	0	678	152	-	21.7	0.000	-	31.5	52.0	3.5	210	85	
	25	1000	14	0.0	0	40	7.8	0	674	158	0.25	18.5	0.000		-	-	2.5	256	60	-
2-u	26	0850	14	0.0	0	43	7.9	0	688	-	-	-	-	0.02	26.3	55.0	-	238	70	43
	27	0900	15	0.4	0	40	8.1	0	674	-	-	-	-	-	-	-	-	234	84	230
	Ave.	-	14	0.1	0	41	7.9	0	679	158	0.25	18.5	0.000	0.02	26.3	55.0	2.5	243	71	
	25	1010	14	0.0	0	39	7.9	0	672	161	0.92	20.0	0.000	-	-	-	3.0	156	100	-
2-L	26	0850	14	0.0	0	41	8.0	0	696	-	-	-	-	-	24.8	55.0	-	320	90	240
	27	0900	15	0.0	0	39	8.2	0	672	-	-	-	-	-	-	-	-	240	80	230
	Ave.	-	14	0.0	0	39	8.0	0	680	161	0.92	20.0	0.000	-	24.8	55.0	3.0	239	90	

LABORATORY ANALYSES

Spring, 1955 (Continued)

KADOKA, SOUTH DAKOTA

STATION Location(1), Depth(2)	DATE April 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN (4) ppm	PHOSPHATE Dis. ppm	PHOSPHATE Org. ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	25	0915	13	0.0	0	45	7.8	0	675	161	1.4	20.7	0.000	-		-	1.5	170	60	-
3-u	26	0730	13	0.0	0	40	[illegible]	0	700	-	-	-	-	-	26.9	56.0	-	246	60	240
	27	0840	15	0.0	0	33	8.2	0	668	-	-	-	-	-	-	-	-	234	72	230
	Ave.	-	13	0.0	0	39	8.0	0	681	161	1.4	20.7	0.000	-	26.9	56.0	1.5	217	64	235
	25	0930	12	0.0	0	20	7.5	0	678	155	24.2	21.3	0.0	-	-	-	3.5	170	160	-
3-L	26	0730	14	0.0	0	40	7.9	0	688	-	-	-	-	-	25.1	50.0	-	240	50	460
	27	0840	15	0.0	0	38	8.2	0	674	-	-	-	-	-	-	-	-	238	20	430
	Ave.	-	14	0.0	0	33	7.9	0	680	155	24.2	21.3	0.0	-	25.1	50.0	3.5	216	77	
	25	0800	13	9.3		50	8.2	0	690	149	0.78	10.8	0.0	-	-	-	4.0	166	150	-
Effluent	26	0715	12	3.4		68	8.1	0	698	-	-	-	-	0.02	34.2	58.0	-	330	110	120
	27	0800	15	0.7		34	8.3	0	674	-	-	-	-	-	-	-	-	234	60	230
	Ave.	-	13	4.5		51	8.2	0	687	149	0.78	10.8	0.0	0.02	34.2	58.0	4.0	243	107	

REMARKS:

(1) Location: Same as winter.

(2) Depth: 1-u, 2-u and 3-u at 0.5'; 1-L at 3.0'; 2-L and 3-L at 5.0'.

(3) 24-hour composite at 2-hour intervals.

(4) Kjeldahl.

LABORATORY ANALYSES
Summer, 1955

KADOKA, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE August 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN (4) ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	1-2	Comp	-	0.0	0	635	7.0	0	456	141	-	36.5	0.005	-		28		512	356	460,000
Raw	2-3	"	-	0.0	0	468	6.8	0	355	50	25.0	44.0	0.011	-		44		728	388	93,000
	3-4	"	-	0.0	0	286	7.0	0	586	105	-	44.8	0.007	-		42		360	406	24,000
	Ave.	-	-	0.0	0	463	7.0	0	466	99	25.0	41.8	0.008	-		38		533	38?	101,000(5)
	2	1045	29	0.0	0	44.0	9.1	115	585	158	-	0.8	0.005			4		232	124	240
1-u	3	0640	26	0.0	0	25.8	8.9	125	705	-	20.0	1.6	0.004			4		216	68	> 110
	4	0715	25	0.0	0	29.4	8.9	126	648	-	-	2.5	0.003			8		196	228	430
	Ave.	-	27	0.0	0	33.1	9.0	122	646	158	20.0	1.6	0.004			5		215	140	
	2	1050	28	0.0	0	21.9	9.0	90	584	154	-	0.9	0.004			4		132	84	43
1-L	3	0640	-	0.0	0	52.4	8.7	50	660	158	6.3	3.0	0.001			7		296	148	> 110
	4	0715	25	0.0	0	28.9	8.8	120	630	160	-	2.3	0.003			9		182	220	93
	Ave.	-	26	0.0	0	34.4	8.8	87	625	157	0.3	2.1	0.003			7		203	151	82
	2	1100	28	0.0	0	26.4	9.0	90	582	156	-	0.8	0.006			5		188	154	460
2-u	3	0650	27	0.0	0	40.8	8.9	120	572	178	0.04	1.6	0.005			5		192	100	46
	4	0725	25	0.0	0	35.4	8.7	198	706	161	-	3.8	0.003			16		188	200	93
	Ave.	-	27	0.0	0	34.2	8.9	136	620	165	0.04	2.1	0.005			9		189	151	
	2	1105	26	0.0	0	-	7.9	0	860	140	-	9.5	0.002			18		312	106	460
2-L	3	0650	24	0.0	0	-	7.6	0	958	-	100	2.2	0.001			12		250	60	93
	4	0725	23	0.0	0	120	7.4	0	935	-	-	13.1	0.002			28		166	88	3.6
	Ave.	-	24	0.0	0	120	7.6	0	918	140	100	8.3	0.002			19		243	85	

LABORATORY ANALYSES
Summer, 1955 (Continued)

KADOKA, SOUTH DAKOTA

STATION Location (1) Depth(2)	DATE Aug. 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN (4) ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	2	1110	24	0.0	0	24.6	9.0	98	640	150	-	2.0	0.002			4		212	168	240
3-u	3	0700	24	0.0	0	21.2	8.9	178	655	175	0.2	1.9	0.004			5		202	92	46
	4	0740	25	0.0	0	24.3	8.6	111	610	158	-	3.2	0.0005			12		170	128	93
	Ave.	-	24	0.0	0	23.4	8.8	129	635	161	0.2	2.4	0.002			7		195	129	
	2	1110	24	0.0	0	—	7.7	0	761	145	-	8.5	0.002			28		180	72	240
3-L	3	0700	27	0.0	0	-	7.6	0	933	-	128	12.0	0.0005			26		326	44	9.3
	4	0740	24	0.0	0	33.0	8.5	128	659	156	-	3.9	0.002			15		150	136	460
	Ave.	-	25	0.0	0	33.0	7.9	0	784	150	128	8.1	0.001			20		219	84	
	2	1015	-	0.0	0	21.0	9.0	97	476	148	-	1.9	0.001			6		69	68	43
Effluent	3	0740	26	0.0	0	100.0	8.8	110	605	173	16.0	2.0	0.004			5		242	172	240
	4	Comp	-	0.0	0	-(3)	8.6	104	603	163	-	3.4	0.002			12		126	124	93
	Ave.	-	-	0.0	0	60.0	8.8	104	561	161	16.0	2.4	0.002			8		146	119	125

REMARKS:

(1) Location: Same as winter.
(2) Depths: Same as spring.
(3) Centrifuged BOD : 9.7 ppm.
(4) Kjeldahl.
(5) Geometric mean.

LABORATORY ANALYSES
Fall, 1955

KADOKA, SOUTH DAKOTA

STATION	Raw	1-u	1-L	2-u	2-L	3-u	3-L	Effluent
Date	11/10-11	11/10	11/10	11/10	11/10	11/10	11/10	11/10-11
Time Collected	24 hr.comp.	1945	1955	2000	2010	2020	2025	24 hr.comp.
Depth	-	0.5'	3.0'	0.5'	5.0'	0.5'	5.0'	-
Temp (°C)	-	3	3	3	3	3	3	-
D.O.	-	0.0	0.0	0.0	0.0	0.0	0.0	-
%Sat.	-	0	0	0	0	0	0	-
BOD	256	31	23	26	50	30	32	35
pH (field)	-	8.45	8.45	8.49	8.49	8.41	8.41	-
Alkalinity, P (field)	-	65	65	65	70	65	70	-
" ,M.O. (field)	-	925	930	930	935	950	945	-
pH (lab)	7.55	8.2	8.2	8.3	*	8.3	8.2	8.15
Alkalinity, P (lab)	0.0	0.0	0.0	Trace	Trace	0.0	0.0	0.0
" ,M.O. (lab)	560	928	928	912	924	924	920	932
Chloride	136.5	181.9	185.0	181.9	175.9	178.9	175.9	181.9
Sulfide	0.0*	1.5	1.5	1.0	1.5	1.5	1.4	0.0*
Ammonia	- *	3.25	3.50	3.50	3.75	3.60	3.25	- *
Nitrite	-	-	-	-	-	-	-	-
Nitrate								
Total Nitrogen								
Total Phosphate								
Ortho Phosphate	-	-	-	-	-	-	-	-
Turbidity	-	-	-	-	-	-	-	-
Suspended Solids	320	132	156	120	152	140	130	108
MPN (x 1000)	46,000	930	930	930	390	930	430	430

Analyses made in field immediately after collection

Analyses made in mobile lab at Philip

* Unpreserved sample
* No sample

Analyses made at Cincinnati
" " " "
" " " "

LABORATORY ANALYSES
Seasonal Summary(1) 1555

WALL, SOUTH DAKOTA

STA.	SEASON	DAYS SAMPLED	TEMP. °C	D.O. ppm	D.O. %Sat.	BOD 5-da ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
Rev	Winter	3	7	1.9	17	298	7.7	0	605	97	0.9	84.0	0.002	0.12	115	63	28	367	287	13,420
	Spring	3	-	-	-	410	7.5	0	485	79	0.0	14.0	0.000	-	61.8	65	5.0	408	298	3,170
	Summer	3	15	0.0	0	256	7.0	0	413	75	0.2	45.1	0.005				23	383	287	63,240
	Fall	1	-	-	-	278	8.5	15	465	88	0.5	13.0	-				-	-	200	46,000
#1	Winter	3	0.3	5.0	0	178	7.6	0	1220	322	80	54.0	0.000	0.12	75.8	66	41	280	43	1,300 430
	Spring	3	12	11.1	111	53	10.5	177	737	161	0.0	10.5	0.000	0.02	46.9	44	6.5	1270	807	15 4.3
	Summer	3	20	0.0	0	36	9.3	142	538	163	0.6	0.9	0.002				4.0	312	210	460 43
	Fall	1	8.5	2.8	21	44	9.5	110	495	143	0.0	0.0	-				-	-	680	240
#2	Winter	3	0.4	0.0	0	143	7.9	0	1390	442	52	39.0	0.000	0.19	62.9	72	55	250	66	2100 850
	Spring	3	14	10.7	111	60	10.5	179	527	161	0	10.5	0.000	-	75.0	53	5.0	2040	775	7.5 2.3
	Summer	3	20	0.2	0	27	9.4	145	543	162	0	0.9	0.002				3.0	335	238	150 15
	Fall	1	0	2.2	17	43	9.5	110	490	143	-	-	-				-	-	860	240
#3	Winter	3	0.3	0.0	0	176	7.4	0	687	138	11	87.0	0.000	0.10	106	61	49	350	159	24000 1100
	Spring	3	14	11.0	111	51	10.5	173	558	161	0	10.5	0.000	-	49.6	54	7.0	1360	830	9.3 9.3
	Summer	3	20	1.2	0	29	9.4	158	595	163	0	0.9	0.003				4.0	331	270	240 93
	Fall	1	0	4.4	33	40	9.9	115	500	143	0	0.0	-				-	-	-	
#4	Winter	3	0.2	0.0	0	201	7.3	0	841	204	35	77.0	0.000	0.15	101	79	56	340	149	4600 1100
	Spring	3	14	7.7	80	54	10.5	169	471	173	0.4	18.2	0.000	0.10	47.0	49	5.5	1570	820	24 43
	Summer	3	20	0.9	0	28	9.4	153	557	165	0	1.1	0.003				4.0	302	240	460 43
	Fall	1	0	2.5	18	41	9.6	100	485	143	0	0.0	-				-	-	800	240

C-10

LABORATORY ANALYSES
Seasonal Summary(1) 1955 (Continued)

WALL, SOUTH DAKOTA

STA.	SEASON	DAYS SAMPLED	TEMP. °C	D.O. ppm	D.O. %Sat.	BOD 5-da ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)	
	Winter	3	0	0.0	0	201	7.5	0	1660	417	89	64.0	0.000	0.11	90.9	98	68	407	59	750	210
#5	Spring	3	15	10.9	110	50	10.4	177	476	162	0	2.6	0.000	-	45.4	52	4.0	1310	730	46	9.3
	Summer	3	20	0.5	0	29	9.4	152	551	163	0	1.1	0.004				5.0	331	260	430	43
	Fall	1	0	5.1	58	39	9.6	100	485	183	0	0.0	-				-	-	100	460	
	Winter	3	0	0.0	0	111	7.8	0	1400	458	58	37.0	0.000	0.16	61.2	61	56	287	77	430	210
#6	Spring	3	15	7.7	83	46	10.5	176	493	158	0	4.0	0.000	-	46.8	53	3.0	1385	730	3.9	2.3
	Summer	3	20	0.3	0	25	9.3	158	500	160	0	1.0	0.003				5.0	321	250	460	39
	Fall	1	0	3.3	24	40	9.6	105	490	183	0	0.0	-				-	-	760	460	

REMARKS:

(1) See individual season data sheets for remarks pertinent to each season.

LABORATORY ANALYSES
Winter (Jan.) 1955

WALL, SOUTH DAKOTA

STATION Location * Depth**	DATE January 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(1) ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE (2) ppm	TOTAL NITROGEN (2) ppm	PHOSPHATE Tot (2) ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
Raw	26	0900	8.0	1.2	8.0	314	8.0	0	553	85	0.7	91	0.003	0.15	102	48	24	450	328	-
	27	0840	6.0	3.3	24.0	127	7.7	0	496	85	0.3	53	0.000	0.13	60	48	24	150	74	7,500
	28	1000	6.0	1.1	8.0	452	7.5	[illegible]	765	122	1.7	108	0.004	0.08	182	93	36	500	460	24,000
	Ave.	-	6.7	1.9	13.3	298	7.7	0	605	97	0.9	84	0.002	0.12	115	63	28	367	287	13,420(3)
#1	26	0800	0.0	0.0	0	155	7.7	0	1200	341	68	50	0	0.11	67	62	33	340	42	1,100
	27	0750	0.8	0.0	0	190	7.5	0	1160	340	86	56	0	0.11	85	69	43	340	40	430
	28	1010	0.0	0.0	0	190	7.6	0	1270	374	86	55	0	0.13	76	66	48	160	48	1,500
	Ave.	-	0.3	0.0	0	178	7.6	0	1210	352	80	54	0	0.12	76	66	41	280	43	-
#2	26	0810	0.4	0.0	0	190	8.2	0	1350	431	51	37	0	0.27	57	76	48	320	94	1,100
	27	0800	0.0	0.0	0	104	7.8	0	1370	443	49	39	0	0.12	64	76	68	270	24	230
	28	1025	0.8	0.0	0	136	7.8	0	1440	451	56	41	0	0.17	67	64	48	160	80	2,100
	Ave.	-	0.4	0.0	0	143	7.9	0	1390	442	52	39	0	0.19	63	72	55	250	66	-
#3	26	0830	0.3	0.0	0	115	7.6	0	668	138	13	79	0	0.11	98	56	48	450	240	1,100
	27	0806	0.0	0.0	0	211	7.5	0	672	121	10	91	0	0.08	109	73	48	320	98	24,000
	28	1030	0.5	0.0	0	202	7.0	0	720	154	11	91	0	0.10	112	53	52	280	140	9,300
	Ave.	-	0.3	0.0	0	176	7.4	0	687	138	11	87	0	0.10	106	61	49	350	159	-
#4	26	0820	0.5	0.0	0	190	7.6	0	764	184	24	77	0	0.10	93	74	40	300	106	1,100
	27	0815	0.0	0.0	0	211	7.3	0	792	187	29	84	0	0.21	111	93	67	400	180	4,600
	28	1040	0.0	0.0	0	202	7.1	0	966	240	51	69	0	0.15	100	71	68	320	160	2,400
	Ave.	-	0.2	0.0	0	201	7.3	0	841	204	35	77	0	0.15	101	79	58	340	149	-

LABORATORY ANALYSES
Winter (Jan.) 1955 (Continued)

WALL, SOUTH DAKOTA

STATION Location * Depth**	DATE January 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(1) ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE (2) ppm	TOTAL NITROGEN (2) ppm	PHOSPHATE Tot. (2) ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	26	0915	0.5	0.0	0	190	7.7	0	1920	411	84	61	0	0.08	89	116	68	500	36	460
#5	27	0830	0.2	0.0	0	211	7.3	0	1500	426	93	66	0	0.08	93	-	68	400	20	210
	28	1100	0.5	0.0	0	202(4)	7.6	0	1560	415	89	64	0	0.16	91	80	68	320	120	750
	Ave.	-	0.4	0.0	0	201	7.5	0	1660	417	89	64	0	0.11	91	98	68	407	59	-
	26	0900	0.0	0.0	0	112	8.0	0	1390	443	49	38	0	0.17	60	72	52	340	88	210
#6	27	0837	0.8	0.0	0	105	7.7	0	1370	449	64	37	0	0.22	62	59	68	340	52	390
	28	1110	0.4	0.0	0	116	7.8	0	1430	483	60	36	0	0.08	62	51	60	180	90	430
	Ave.	-	0.4	0.0	0	111	7.8	0	1400	458	58	37	0	0.16	61	61	60	287	77	-

C-13

* Locations:
Raw: Man Hole at West end of North dike.
#1 : 200 ft. East of West dike — in line with utility pole and island. (500 ft. from inlet)
#2 : Center of line between utility pole and island. (250 ft. from inlet)
#3 : 100 ft. South of inlet — in line with Station 2.
#4 : 300 ft. SouthEast of inlet — in line with island.
#5 : 100 ft. West of outlet — in line with utility pole. (350 ft. from inlet)
#6 : 100 ft. North of South dike — in direct line of utility poles. (500 ft. from inlet)

** Depth (inches)

	Total	Ice	Sample
#1	15	10	4
#2	16	12½	5
#3	13	9½	2
#4	15	10	4
#5	16	13	5
#6	22	11½	11

REMARKS:
(1) All samples transported from Philip to Lemmon during incubation.
(2) Analyses made in Cincinnati.
(3) Geometric mean
(4) BOD of filtered sample (#12 Whatman paper) : 168 ppm.

LABORATORY ANALYSES
Spring 1955

WALL, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE April 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(4) ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL PHOSPHATE ppm	PHOSPHATE [illegible] ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	28-29	1000-0800	-	-	-	367	7.3	-	-	79	0.0	14.0	0.0	0.0	61.8	65.0	5.0	370	420	2,300
Raw	29-30	1000-0800	-	-	-	312	7.8	0	430	-	-	-	-	-	-	-	-	425	176	3,000
	5/2	0800(3)	-	-	-	550	-	0	520	-	-	-	-	-	-	-	-	430	-	4,600
	Ave.	-	-	-	-	410	7.5	0	465	779	0.0	14.0	0.0	0.0	61.8	65.0	5.0	408	298	3,170(5)
	29	0830	11.5	18.1	178	56	10.1	-	-	161	0.0	10.5	0.0	0.02	46.9	44.0	6.5	1010	880	15
#1	30	0705	14.0	2.5	26	59	10.4	170	955	-	-	-	-	-	-	-	-	2000	1020	4.3
	5/2	0630	12.0	12.8	128	43	11.0	185	520	-	-	-	-	-	-	-	-	800	520	-
	Ave.	-	12.5	11.1	112	53	10.5	177	737	161	0.0	10.5	0.0	0.02	46.9	44.0	6.5	1270	807	-
	29	0845	11.5	15.0	149	84	10.0	-	-	161	0.0	10.5	0.0	0.0	75.0	53.0	5.0	3440	-	7.5
#2	30	0715	14.0	2.9	30	55	10.3	163	630	-	-	-	-	-	-	-	-	1870	1070	2.3
	5/2	0700	17.0	14.1	155	42	11.1	195	425	-	-	-	-	-	-	-	-	800	480	-
	Ave.	-	14.2	10.7	112	60	10.5	179	527	161	0.0	10.5	0.0	0.0	75.0	53.0	5.0	2040	775	
	29	0900	11.5	18.3	181	52	10.1	-	-	161	0.0	10.5	0.0	0.0	49.6	54.0	7.0	1400	820	9.3
#3	30	0720	14.0	3.2	33	52	10.3	162	685	-	-	-	-	-	-	-	-	1750	1010	9.3
	5/2	0710	18.0	11.4	128	48	11.1	185	432	-	-	-	-	-	-	-	-	930	670	-
	Ave.	-	14.5	11.0	116	51	10.5	173	556	161	0.0	10.5	0.0	0.0	49.6	54.0	7.0	1360	830	
	29	0915	12.0	12.2	122	48	10.1	-	-	173	0.4	18.2	0.0	0.1	47.0	49.0	5.5	1230	590	4.3
#4	30	0730	13.5	1.7	175	69	10.1	155	530	-	-	-	-	-	-	-	-	2650	1390	24.0
	5/2	0715	18.0	9.1	102	46	11.2	183	413	-	-	-	-	-	-	-	-	830	480	-
	Ave.	-	14.5	7.7	81	54	10.5	169	471	173	0.4	18.2	0.0	0.1	47.0	49.0	5.5	1570	820	

LABORATORY ANALYSES
Spring 1955 (Continued)

WALL, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE April 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(4) ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	29	0925	12.0	16.9	169	52	10.0	-	-	162	0.0	2.6	0.0	0.0	45.4	52.0	4.0	1400	590	46
#5	30	0735	14.0	4.2	43	55	10.2	180	568	-	-	-	-	-	-	-	-	1750	1060	9.3
	5/2	0725	18.0	9.9	111	44	11.1	175	385	-	-	-	-	-	-	-	-	780	550	-
	Ave.	-	15.0	10.3	110	50	10.4	177	476	162	0.0	2.6	0.0	0.0	45.4	52.0	4.0	1310	730	
	29	0935	12.0	10.8	108	48	10.1	-	-	158	0.0	4.0	0.0	0.0	46.8	53.0	3.0	1200	610	2.3
#6	30	0745	14.0	3.8	39	47	10.3	157	582	-	-	-	-	-	-	-	-	1920	1000	3.9
	5/2	0735	18.0	8.5	96	44	11.1	195	405	-	-	-	-	-	-	-	-	1030	580	-
	Ave.	-	15.0	7.7	82	46	10.5	176	493	158	0.0	4.0	0.0	0.0	46.8	53.0	3.0	1385	730	

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REMARKS:

(1) Same locations as winter run.
(2) All samples collected at depth of one inch.
(3) Grab sample.
(4) All samples transported from Philip to Lemmon during incubation.
(5) Geometric mean.

LABORATORY ANALYSES
Summer 1955

WALL, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE August 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(5) 5-day ppm	pH	ALKALINITY P ppm	ALKALINITY T ppm	CHLORIDES ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL PHOSPHATE ppm	PHOSPHATE Diss. ppm	PHOSPHATE Organic ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	6-7	24-hr.Comp.	-	0.0	0	260	7.1	0	407	68	0.2	53.1	0.004				18	506	286	93,000
Raw	7-8	"	15.5	0.0	0	184	7.2	0	462	78	-	38.0	0.007				18	264	220	-
	8-9	"	-	0.0	0	323	6.8	0	370	78	-	44.3	0.005				32	380	356	43,000
	Ave.		-	0.0	0	256	7.0	0	413	75	0.2	45.1	0.005				23	383	287	63,240(4)
	7	0640	19.0	0.0	0	50	9.3	130	430	158	0.6	0.9	0.002				4	-	-	93
#1	8	0630	18.0	0.0	0	28	9.2	155	605	160	-	0.7	0.002				4	308	260	460
	9	0655	22.0	0.0	0	31	9.5	140	580	172	-	1.0	0.003				4	315	160	43
	Ave.	-	20	0.0	0	36	9.3	142	538	163	0.6	0.9	0.002				4	312	210	
	7	0705	19	0.0	0	25	9.4	145	500	158	0.0	1.0	0.001				3	374	213	93
#2	8	0635	18	0.0	0	25	9.2	140	560	159	-	0.6	0.003				3	297	290	150
	9	0700	22	0.6	0	30	9.4	150	570	169	-	1.0	0.003				4	335	210	15
	Ave.	-	20	0.2	0	27	9.4	145	543	162	0.0	0.9	0.002				3	335	238	
	7	0710	19	2.4	28	28	9.4	175	685	158	0.0	1.1	0.001				5	352	280	93
#3	8	0640	18	0.0	0	24	9.2	150	544	159	-	0.6	0.004				4	286	240	240
	9	0705	22	1.1	10	35	9.5	150	555	173	-	1.1	0.003				4	355	280	240
	Ave.	-	20	1.2	10	29	9.4	158	595	163	0.0	0.9	0.003				4	331	270	
	7	0715	19	0.0	0	26	9.4	160	527	158	0.0	1.5	0.001				5	286	250	43
#4	8	0645	18	0.3	0	24	9.2	122	580	162	-	0.6	0.005				4	286	250	460
	9	0710	22	1.3	15	34	9.4	175	563	174	-	1.2	0.002				4	335	230	93
	Ave.	-	20	0.9	10	28	9.4	152	557	165	0.0	1.1	0.003				4	302	240	

LABORATORY ANALYSES
Summer 1955 (Continued)

WALL, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE August 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(3) 5-day ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFATE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Sol. ppm	PHOSPHATE Insol. ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	7	0720	19	0.0	0	25	9.4	163	520	153	0.0	1.6	0.003				4	385	250	43
#5	8	0650	18	0.0	0	28	9.1	141	591	160	-	0.5	0.005				4	297	280	93
	9	0715	22	1.4	15	33	9.4	152	542	176	-	1.3	0.003				6	310	260	430
	Ave.	-	20	0.5	5	29	9.4	152	551	163	0.0	1.1	0.004				5	331	260	
	7	0725	20	0.0	0	25	9.4	173	493	153	0.0	1.3	0.001				4	352	220	240
#6	8	0655	18	0.0	0	20	9.1	152	555	153	-	0.6	0.005				4	297	270	460
	9	0720	22	1.0	10	31	9.3	150	450	174	-	1.0	0.002				6	315	270	39
	Ave.	-	20	0.3	0	25	9.3	158	500	160	0.0	1.0	0.003				5	321	250	

REMARKS:

(1) Same locations as winter run.
(2) All samples except #6 collected at 1-2 inches; #6 collected at 0.5 ft. depth.
(3) All samples transported from Philip to Lemmon during incubation.
(4) Geometric mean.

LABORATORY ANALYSES
Fall 1955

WALL, SOUTH DAKOTA

STATION	Raw	#1	#2	#3	#4	#5	#6	
Depth	-	0.1'	0.1'	0.1'	0.1'	0.1'	0.5'	
Date	11/10-11	11/11	11/11	11/11	11/11	11/11	11/11	
Time	24 hr.comp.	1345	1415	1445	1500	1515	1530	
Temp (°C)	-	0.5	0.0	0.0	0.0	0.0	0.0	
D.O.	-	2.85	2.25	4.45	2.50	5.10	3.32	
% Sat.	-	21	17	33	18	38	24	
BOD	278	44	43	40	41	39	40	
pH	8.48	9.52	9.52	9.52	9.57	9.57	9.56	]
Alkalinity (P)	15	110	110	115	100	100	105	] Analyses made in field,
Alkalinity (M.O.)	465	495	490	500	485	485	490	] immediately after collected
pH	7.25	9.1	9.3	8.9	9.05	9.1	8.95	]
Alkalinity (P)	0.0	64	74	72	72	78	72	] Analyses made in mobile lab
Alkalinity (M.O.)	528	486	482	486	488	482	482	] at Philip
Chloride	87.96	143	143	143	143	143	143	
Sulfide	0.5	0.0	- *	0.0	0.0	0.0	0.0	* No sample
Ammonia	13.0	0.0	- *	0.0	0.0	0.0	0.0	* No sample
Nitrite	-	-	-	-	-	-	-	
Nitrate								
Total Nitrogen								
Total Phosphate								
Ortho "	-	-	-	-	-	-	-	
Turbidity	-	-	-	-	-	-	-	
Suspended Solids	200	680	860	2200 *	800	100	760	* Shows evidence of bottom materials
MPN (x 1000)	46,000	240	240	240	240	460	460	

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LABORATORY ANALYSES
Seasonal Summary (A) 1955

LEMMON, SOUTH DAKOTA

STA.	SEASON	DAYS SAMPLED /Depth	TEMP. °C	D.O. ppm	D.O. %-sat.	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY T ppm	CHLOR-IDE ppm	SUL- ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE		TURB.	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	Winter	3	10	0.3	-	400	8.2	0	933	214	1.4	51.0	0.204	0.10	82.3	45.4	27.0	473	370	19,000
Raw	Spring	3	11	2.8	-	252	8.0	0	805	233	0.1	23.7	0.137	0.02	50.3	51.6	1.0	650	384	4,580
	Summer	3	-	-	-	142	8.0	0	511	133	0.0	41.8	0.021				22.0	285	228	34,900
	Fall	1	-	-	-	165	8.2	0	860	170	Tr.	4.6	-				20.0	-	316	2,300
	Winter	3/1.5'	1	3.3	17	44	8.6	45	857	202	0	10.1	0.011	0.10	17.8	19.3	15.0	130	68	823
1	Spring	3/1.5'	10	8.6	84	31	9.3	63	830	233	0	2.2	0.333	0.00	9.8	25.2	1.0	300	120	78
	Summer	3/1.5'	22	4.3	54	16	9.5	150	525	177	0	1.6	0.135				4.0	81	51	163
	Fall	1/1.5'	2	9.9	79	21	9.2	90	790	200	0	0.7	-				0.7	-	104	150
	Winter	3/3.0'	1	2.7	21	28	8.6	50	851	201	0	7.9	0.004	0.08	13.6	18.8	13.0	110	65	99
2	Spring	2/1.5'	11	8.8	87	28	9.0	100	887	255	0	2.2	0.391	0.02	9.5	20.8	1.5	220	60	29
	Summer	3/1.5'	22	3.2	40	11	9.5	144	485	180	0	2.1	0.151				3.0	77	44	13
	Fall	1/1.5'	2	6.5	52	20	9.1	105	765	188	0	0.7	-				0.7	-	128	93
	Winter	3/3.0'	1	1.0	8	26	8.6	49	854	202	0	7.4	0.002	0.08	12.0	17.4	12.0	107	73	34
3-u	Spring	3/1.5'	10	9.1	88	32	9.0	86	807	218	0	2.2	0.712	-	-	-	1.0	300	140	47
	Summer	3/1.5'	23	7.9	100	13	9.6	140	617	183	0	2.1	0.150	-			4.0	81	57	46
	Fall	1/1.5'	2	7.9	63	18	9.1	140	785	194	0	0.7	-				0.7	-	100	43
	Winter	3/9.0'	2	0.0	0	29	8.5	41	861	207	6.7	9.0	0.005	0.09	13.3	14.6	11.0	143	84	217
3-L	Spring	3/6.0'	10	9.1	88	35	9.0	88	870	237	0	2.2	0.375	0.15	9.4	18.4	1.0	297	83	32
	Summer	3/6.0'	22	2.4	30	9	9.5	456	609	186	0	8.3	0.142				4.0	71	46	20
	Fall	1/6.0'	3	7.8	64	13	9.1	110	790	188	0	0.7	-				0.7	-	96	93

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LABORATORY ANALYSES
Seasonal Summary (1) 1955 (Continued)

LEMMON, SOUTH DAKOTA

STA.	SEASON	DAYS SAMPLED /Depth	TEMP. °C	D.O ppm	D.O %Sat.	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Total ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	Winter	3/3.0'	1	2.7	21	27	8.6	53	850	201	0	8.2	0.013	0.13	13.3	16.5	10.0	113	53	37
4-a	Spring	2/1.5'	11	8.4	83	27	9.0	130	840	270	0	2.2	0.529	0.00	9.5	18.8	0.5	226	110	58
	Summer	3/1.5'	23	7.1	90	14	9.6	144	618	183	0	2.4	0.156				3.0	86	69	21
	Fall	1/1.5'	2	8.3	66	15	9.0	120	800	194	0	0.8	-				0.7	-	104	240
	Winter	3/7.5'	2	0.2	2	26	8.6	51	854	206	16.0	7.3	0.008	0.08	11.9	16.8	13.0	110	56	58
4-L	Spring	0/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Summer	3/6.0'	23	6.6	84	14	9.5	147	619	183	0	8.1	0.163				3.0	83	59	11
	Fall	1/4.0'	2	8.5	67	11	9.0	115	805	194	0	0.7	-				0.7	-	120	150
	Winter	3/0.1'	1	3.8	30	35	8.6	57	843	200	0	7.7	0.005	0.11	13.7	16.0	10.0	117	39	36
	Spring	3/0.1'	11	8.7	86	29	9.2	90	850	197	0	2.2	0.500	0.00	9.5	18.8	0.7	348	145	36
Effl.	Summer	3/0.1'	-	-	-	10	9.6	145	621	184	0	2.4	0.233				4.0	72	58	67
	Fall	1/0.1'	2	7.6	60	12	9.1	140	725	176	0	0.7	-				0.7	-	104	930

REMARKS:

(1) See individual season data sheets for remarks pertinent to each season

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LABORATORY ANALYSES
Winter (Feb.) 1955

LEMMON, SOUTH DAKOTA

STATION: Location(1) Depth(2)	DATE Jan-Feb 1955	TIME	TEMP °C	D.O. ppm	D.O. % Sat	B.O.D.(3) 5-day ppm	pH	ALKALINITY P ppm	ALKALINITY T ppm	CHLORIDE ppm	SULFATE ppm	AMMONIA ppm	NITRITE ppm	NITRATE (+) ppm	TOTAL (+) ppm	PHOSPHATE ppm	PHOSPHATE ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
Raw	1/31	1510	10	0.6	-	670	7.7	0.0	944	231	2.3	45.0	0.110	0.14	72.8	73.6	24	800	540	
	2/1	1030	10	0.0	-	327	8.6	32	972	217	1.0	59.0	0.202	0.10	102.0	32.4	36	400	330	24,000
	2/2	0940	11	0.3	-	202	8.4	22	884	194	1.0	48.0	0.300	0.07	72.0	30.1	20	220	240	15,000
	Ave.	-	10	0.3	-	400	8.2	-0-	933	214	1.4	51.0	0.204	0.10	82.3	45.4	27	473	370	(5)29,000
1	1/31	1130	-	3.3	-	38	8.5	45	857	203	0	10.5	0.010	0.14	16.4	17.6	16	130	28	110
	2/1	0935	1	3.1	24	43	8.6	54	856	201	0	8.5	0.019	0.08	18.2	21.2	16	130	76	2,100
	2/2	0940	2	0.2	2	50	8.6	36	859	203	0	11.2	0.003	0.08	18.8	19.2	14	130	100	2,400
	Ave.	-	1	2.2	17	44	8.6	45	857	202	0	10.1	0.011	0.10	17.8	19.3	15	130	68	(5) 823
2	1/31	1140	-	0.2	-	24	8.5	52	854	201	0	8.2	0.001	0.09	12.9	20.4	11	110	52	110
	2/1	0930	1	1.2	9	27	8.6	52	843	199	0	8.3	0.005	0.03	15.5	16.8	15	110	72	93
	2/2	0920	1	6.8	53	32	8.6	45	856	202	0	7.3	0.007	0.13	12.3	19.2	12	110	72	93
	Ave.	-	1	2.7	21	28	8.6	50	851	201	0	7.9	0.004	0.08	13.6	18.8	13	110	65	99
3-u	1/31	1150	-	0.6	-	25	8.6	53	851	201	0	7.3	0.002	0.13	11.5	18.8	10.	110	36	46
	2/1	1000	1	1.6	12	26	8.7	46	853	200	0	6.8	0.002	0.04	12.9	17.6	14	110	120	23
	2/2	0840	1	0.7	5	27	8.6	49	858	204	0	8.1	0.001	0.07	11.6	15.7	12	100	64	-
	Ave.	-	1	1.0	8	26	8.6	49	854	202	0	7.4	0.002	0.08	12.0	17.4	12	107	73	34
3-L	1/31	1200	-	0	0	34	8.3	34	868	210	13.5	9.7	0.004	0.12	14.6	12.8	14	210	140	240
	2/1	1010	3	0	0	25	8.6	44	862	206	2.6	7.4	0.010	0.06	12.8	16.4	10	110	56	210
	2/2	0900	2	0	0	29	8.6	44	852	204	3.9	9.8	0.002	0.09	12.4	14.6	10	110	56	200
	Ave.	-	2	0	0	29	8.5	41	861	207	6.7	9.0	0.005	0.09	13.3	14.6	11	143	84	217

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LABORATORY ANALYSES
Winter (Feb.) 1955 (Continued)

LEMMON, SOUTH DAKOTA

Station(1) Location Depth	Date Jan-Feb 1955	Time	Temp °C	D.O. ppm	D.O. %Sat	B.O.D.(3) 5-day ppm	pH	Alkalinity P ppm	Alkalinity T ppm	Hardness as CaCO3 ppm	Solids Total ppm	Ammonia ppm	Nitrite ppm	Nitrate (4) ppm	Phosphate Total (4) ppm	Phosphate Ortho (4) ppm	Phosphate Ortho ppm	Turb. ppm	Solids Susp. ppm	Coliform MPN/100 ml (x 1000)
	1/31	1430	-	2.6	-	24	8.6	56	847	199	0	9.3	0.012	0.08	14.3	16.4	10	120	32	46
4-u	2/1	1015	1	2.3	18	29	8.7	50	853	201	0	6.6	0.020	0.04	13.7	20.0	10	120	68	43
	2/2	0830	1	3.2	25	28	8.6	54	850	204	0	8.6	0.006	0.26	12.0	13.1	10	100	60	23
	Ave.	-	1	2.7	21	27	8.6	53	850	201	0	8.2	0.013	0.13	13.3	16.5	10	113	53	37
	1/31	1440	-	0.4	-	29	8.5	44	848	209	1.5	7.3	0.010	0.10	10.6	16.4	12	110	44	-
4-L	2/1	1025	2	0.0	0	22	8.7	48	862	207	1.8	6.9	0.012	0.03	13.6	19.6	14	110	68	93
	2/2	0835	2	0.1	1	23	8.6	60	853	202	1.5	7.8	0.002	0.10	11.5	14.4	12	110	56	23
	Ave.	-	2	0.2	2	26	8.6	51	854	206	1.6	7.3	0.008	0.08	11.9	16.8	13	110	56	58
	1/31	1220	-	1.3	-	39	8.5	42	844	201	0	8.1	0.004	0.13	14.6	14.8	10	130	40	46
Effluent	2/1	0950	1	4.1	32	32	8.6	62	830	198	0	6.6	0.008	0.15	13.2	19.0	10	110	56	20
	2/2	0900	1	6.1	47	35	8.6	67	855	202	0	8.4	0.003	0.06	13.4	14.2	10	110	20	43
	Ave.	-	1	3.8	30	35	8.6	57	843	200	0	7.7	0.005	0.11	13.7	16.0	10	117	39	36

REMARKS:

#1 (1) Location: 200 ft. from inlet on line between inlet and outlet.
#2 (1) " : 500 " " " " " " " " " "
#3-u (1) " : 200 " NW " outlet.
#3-L (1) " : " " " "
#4-u (1) " : 600 " " " "
#4-L (1)
Effluent: (1) " : At outlet structure

(2) Depth: 1'-6" (Ice: 14", Total: 2'-9")
(2) " : 3'-0" (" : 14", " : 5'-0")
(2) " : 3'-0" (" : 14", " : 10'-3")
(2) " : 9'-0" (" : 14", " : ")
(2) " : 3'-0" (" : 13", " : 8'-10")
(2) " : 7'-6"
(2) " : Surface

(3) All samples transported to Maddock during incubation
(4) Analysis made in Cincinnati
(5) Geometric mean

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LABORATORY ANALYSES
Spring 1955

LEMMON, SOUTH DAKOTA

STATION Location(2) Dam'L's	DATE May 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(1) ppm	pH	ALKALINITY P ppm	ALKALINITY T ppm	CHLOR. ppm	SUL. ppm	AMMONIA ppm	NITRITE ppm	NITRATE (4) ppm	TOTAL PHOS. (3) ppm	PHOSPHATE Ortho (3) ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp ppm	COLIFORM MPN/100 ml (x 1000)
Raw	3-4	Comp	-	-	-	290	7.9	0	690	-	-	-	-	-	-	-	-	1250	612	4,300
	4-3	"	-	-	-	185	8.1	0	875	233	0.1	23.7	0.137	0.02	50.3	51.6	1.0	282	130	2,400
	5-6	"	-	-	-	280	8.0	0	850	-	-	-	-	-	-	-	-	426	410	9,300
	Ave.	-	-	-	-	252	8.0	0	805	233	0.1	23.7	0.137	0.02	50.3	51.6	1.0	650	384	(5) 4,580
1	4	1015	9	9.5	91	38	9.4	8	770	-	-	-	-	-	-	-	-	480	140	21
	5	0510	10	8.1	79	33	9.2	115	875	233	0	2.2	0.333	0.00	9.8	25.2	1.0	205	110	93
	6	0500	12	8.1	83	21	9.3	63	850	-	-	-	-	-	-	-	-	214	110	240
	Ave.	-	10	8.6	84	31	9.3	63	830	233	0	2.2	0.333	0.00	9.8	25.2	1.0	300	120	(5) 78
2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	0525	10	8.4	82	29	8.9	75	910	255	0	2.2	0.391	0.02	9.5	20.8	1.5	240	30	43
	6	0510	12	9.3	95	27	9.2	125	865	-	-	-	-	-	-	-	-	205	90	15
	Ave.	-	11	8.8	87	28	9.0	100	887	255	0	2.2	0.391	0.02	9.5	20.8	1.5	220	60	29
3-u	4	1050	9	8.8	84	39	9.0	9	790	-	-	-	-				-	430	120	24
	5	0450	10	7.7	75	31	9.1	115	790	228	0	2.2	0.712				1.0	256	180	93
	6	0520	12	10.7	109	26	9.0	135	840	-	-	-	-				-	214	120	24
	Ave.	-	10	9.1	88	32	9.0	86	807	218	0	2.2	0.712				1.0	300	140	47
3-L	4	1050	9	9.1	87	45	9.1	10	790	-	-	2.2	0.375	-	-	-	-	460	108	43
	5	0450	10	7.7	75	32	9.0	120	970	237	0	-	-	0.15	9.4	18.4	1.0	220	50	43
	6	0525	12	10.6	108	28	9.0	135	850	-	-	-	-	-	-	-	-	210	90	9.3
	Ave.	-	10	9.1	88	35	9.0	88	870	237	0	2.2	0.375	0.15	9.4	18.4	1.0	297	83	32

LABORATORY ANALYSES
Spring 1955 (Continued)

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LEMMON, SOUTH DAKOTA

STATION Location(2) Depth(3)	DATE May 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(1) ppm	pH	ALKALINITY P ppm	ALKALINITY M ppm	CHLOR. ppm	SULF. ppm	AMMONIA ppm	NITRITE ppm	NITRATE (4) ppm	TOTAL NITROGEN (4) ppm	PHOSPHATE ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-u	5	0445	10	7.1	75	28	9.0	110	810	270	0	2.2	0.529	0.00	9.5	18.8	0.5	239	130	24
	6	0525	12	9.1	93	27	9.1	150	870	-	-	-	-	-	-	-	-	214	90	93
	Ave.	-	11	8.4	83	27	9.0	130	840	270	0	2.2	0.529	0.00	9.5	18.8	0.5	226	110	58
4-L	4] 5] 6] Ave]	Not sampled																		
	4	1110	9	8.5	81	-	9.1	10	840	-	-	—	-	-	-	-	-	580	224	43
Effluent	5	0540	11	8.8	87	34	9.2	140	905	197	0	2.2	0.500	0.00	9.5	18.8	0.75	254	100	43
	6	0545	12	8.8	90	25	9.2	120	800	-	-	-	-	-	-	-	-	210	110	21
	Ave.		11	8.7	86	29	9.2	90	850	197	0	2.2	0.500	0.00	9.5	18.8	0.75	348	145	36

REMARKS:

(1) All samples transported from Lemmon to Bismarck during incubation.
(2) See data sheet for Winter 1955 (same sample stations)
(3) Stations 1, 2, 3-u, and 4-u collected at 1.5 ft. depth; 3-L from 6.0' depth.
(4) Analyses made in Cincinnati; preserved with 1500 ppm sulfuric acid.
(5) Geometric mean.

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LABORATORY ANALYSES

Summer 1955

LEMMON, SOUTH DAKOTA

STATION Location(1) Depth(2)	DATE Aug. 1955	TIME	AIR °C	D.O. ppm	D.O. % Sat.	BOD(3) ppm	pH	ALKALINITY P ppm	ALKALINITY M ppm	CHLORIDES ppm	SUSP. SOLIDS ppm	AMMONIA ppm	NITRITE ppm	NITRATE (5) ppm	TOTAL PHOSPHATE (5) ppm	ORTHO PHOSPHATE (5) ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100 ml (x 1000)	
	10-11	Comp(6)	-	-	-	154	8.1	0	364	143	0	36.5	0.050				22	318	228	43,000	
Raw	11-12	"	-	-	-	151	8.1	0	368	123	-	44.0	0.009				20	274	260	23,000	
	12-13	"	-	-	-	122	7.8	0	862	133	-	44.8	0.005				22	264	196	43,000	
	Ave.	-	-	-	-	142	8.0	0	511	133	0	41.8	0.021				22	285	228	(7) 34,900	
	11	0935	22	7.1	89	24.8	9.7	84	322	182	0	0.8	0.169				2	98	72	39	
1	12	0805	22	4.2	52	10.1	9.5	192	480	174	-	1.6	0.101				4	69	36	240	
	13	0730	22	1.5	19	13.0	9.2	172	772	176	-	2.5	0.075				5	76	46	210	
	Ave.	-	22	4.3	54	16	9.5	150	525	177	0	1.6	0.235				4	81	51	163	
	11	0940	22	5.3	66	14.4	9.7	86	310	180	0	0.9	0.178				2	90	56	93	
2	12	0800	23	3.2	40	8.7	9.5	166	368	179	-	3.0	0.165				4	72	28	2.3	
	13	0715	22	1.2	15	9.9	9.3	180	778	180	-	2.3	0.111				4	68	48	9.3	
	Ave.	-	22	3.2	40	11	9.5	144	485	180	0	2.1	0.151				3	77	44	13	
	11	0945	23	4.4	56	12.0	9.7	58	310	178	0	0.8	0.159				3	82	52	43	
3-u	12	0600	23	18.0	228	19.4	9.7	180	762	183	-	1.6	0.191				5	98	52	240	
	13	0700	22	1.3	16	8.8	9.3	182	780	187	-	3.8	0.100				4	63	68	9.3	
	Ave.	-	23	7.9	100	13	9.6	140	617	183	0	2.1	0.150				4	81	57	46	
	11	0950	23	3.8	48	10.4	9.7	94	312	188	0	9.5	0.150				3	92	54	23	
3-L	12	0800	22	2.2	27	8.1	9.5	184	738	185	-	2.2	0.176				4	67	36	23	
	13	0700	22	1.1	14	7.4	9.3	178	778	185	-	13.1	0.100				4	53	48	15	
	Ave.	-	22	2.4	30	9	9.5	152	609	186	0	8.3	0.142				4	71	46	20	

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LABORATORY ANALYSES
Summer 1955 (Continued)

LEMMON, SOUTH DAKOTA

STATION (Location(1) Depth(2))	DATE 1955	TIME	TEMP °C	D.O. ppm	D.O. %	BOD(3) ppm	PH	ALKALINITY ppm	HARDNESS ppm	CHLORIDES ppm	SUSP. SOLIDS ppm	AMMONIA ppm	NITRITE ppm	NITRATE (5) ppm	TOTAL ppm	PHOSPHATE ppm	TURB ppm	SOLIDS ppm	COLIFORM MPN/100 ml (x 1000)
4-u	11	1000	23	8.2	104	14.2	9.7	70	316	182	0	2.0	0.169			2	82	64	23
	12	0740	23	11.5	146	17.7	9.7	180	756	184	-	1.9	0.187			3	102	84	43
	13	0640	22	1.6	20	11.3	9.3	182	782	183	-	3.2	0.111			4	73	58	9.3
	Ave.	-	23	7.1	90	14	9.6	144	618	183	0	2.4	0.156			3	86	69	21
4-L	11	1005	23	7.6	96	12.3	9.7	86	308	182	0	8.5	0.194			2	92	50	4.3
	12	0740	23	10.8	137	18.8	9.6	176	766	183	-	12.0	0.195			3	92	48	23
	13	0640	22	1.4	17	10.0	9.3	178	782	185	-	3.9	0.100			4	66	78	15
	Ave.	-	23	6.6	84	14	9.5	147	619	183	0	8.1	0.163			3	83	59	11
Effl.	10-11	Comp(6)	-	-	-	10.9	9.7	84	320	182	0	1.9	0.394			2	64	58	15
	11-12	"	-	-	-	9.6	9.6	184	752	184	-	2.0	0.205			4	87	64	93
	12-13	"	-	-	-	9.8	9.4	168	792	185	-	3.4	0.100			4	66	52	93
	Ave.	-	-	-	-	10 (4)	9.6	145	621	184	0	2.4	0.233			4	72	58	67

REMARKS:

(1) Location of sample stations: see data sheet for Winter 1955.
(2) Depth: Stations 1, 2, 3-u, 4-u at 1.5 feet; 3-L and 4-L at 6.0 feet.
(3) All samples transported from Lemmon to Bismarck during incubation.
(4) Effluent BOD on Aug. 21: 16.5 ppm; same sample after centrifuging: 3.9 ppm.
(5) Analyses made in Cincinnati; samples preserved with sulfuric acid. (1500 ppm)
(6) 24 hour composites collected at 2-hour intervals from 2000-0600 and one-hour intervals from 0600 through 2000.
(7) Geometric mean.

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LABORATORY ANALYSES
Fall 1955

LEMMON, SOUTH DAKOTA

Station (1)	Raw	#1	#2	#3-U	#3-L	#4-U	#4-L	Effluent
Depth	-	1.5'	1.5'	1.5'	6.0'	1.5'	6.0'	Surface
Date	11/8-9/55	11/8	11/8	11/8	11/8	11/8	11/8	11/8
Time	24 hr.comp.	1330	1320	1310	1300	1255	1255	1250
Temp.(°C)	-	2.0	2.0	2.0	3.0	2.0	2.0	2.0
D.O.	-	9.90	6.50	7.95	7.80	8.30	8.50	7.60
% Sat.	-	79	52	63	64	66	67	60
B.O.D.	165	21	20	18	13	15	11	12
pH	8.35	9.20	9.15	9.10	9.10	9.00	9.00	9.10)*
Alkalinity (P)		90	105	140	110	120	115	140)*
" (M.O.)	860	790	765	785	790	800	805	725)*
pH	8.0	9.0	9.0	8.9	8.9	8.9	8.95	8.95)**
Alkalinity (P)	0.0	76	76	76	68	44	52	48)**
" (M.O.)	876	792	796	800	796	848	788	720)**
Chloride	170	200	188	194	188	194	194	176
Sulfide	Trace	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia	4.60	0.70	0.75	0.70	0.75	0.80	0.75	0.75
Nitrite	-	-	-	-	-	-	-	-
Nitrate								)***
Total Nitrogen								)***
Total Phosphate								)***
Ortho Phosphate	20.0	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Turbidity	-	-	-	-	-	-	-	-
Suspended Solids	316	104	128	100	96	104	120	104
MPN (x 1000)	2,300	150	93	43	93	240	150	930

(1) Location of sample stations same as shown on Winter 1955 Data Sheet
(*) Analyses made at Lemmon, immediately after collection
(**) Analyses made in mobile lab at Philip
(***) Analyses made in Cincinnati; samples preserved with chloroform.

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LABORATORY ANALYSES
Seasonal Summary (2) 1955

MADDOCK, NORTH DAKOTA

STA.	SEASON	DAYS (Sampled) /Depth	TEMP. °C	D.O. ppm	D.O. % Sat.	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY T ppm	COLOR	SUL-	AMMONIA	NITRITE	NITRATE	TOTAL	PHOSPHATE		TURB.	SOLIDS	COLIFORM
	Winter	2/-	-	3.0	-	357	7.9	0.0	605	105	2.7	44.5	0.331	0.12	73.6	53.4	36	425	394	32,000
Raw	Spring	3/-	5.)	6.0	-	137	7.8	0.0	627	182	0.0	7.0	0.306	0.00	41.4	32.8	1.0	186	297	2,580
	Summer	3/-	- -	-	-	390	7.7	-	580	106	0.0	15.3	0.207				30	304	270	32,200
	Fall	1	-	-	-	185	8.1	0.0	590	130	0.5	50.0	0.330				45	310	197	930
	Winter	3/0.5' below ice	0.0	0.0	0.0	77	8.1	-	912	295	118	19.6	0.004	0.09	20.9	26.2	25	220	45	310
#1	Spring	3/1.5'	9	13.1	120	20	9.0	137	595	188	0.0	4.5	0.012	0.00	11.8	21.2	1.0	234	137	28
	Summer	3/0.5'	21	0.7	8	10	8.8	95	602	187	0.0	1.3	0.003				8	91	45	138
	Fall	1/0.5'	0.0	9.9	72	4.0	8.4	50	670	199	0.0	23.5	0.160				19.4	180	77	23
	Winter	3/2.25'	1	0.0	0.0	88	8.1	-	869	269	114	19.5	0.018	0.08	21.0	26.1	28	230	49	1,800
#2	Spring	3/1.5'	10	12.6	116	15	8.9	135	585	160	0.0	4.45	0.015	0.02	11.5	20.0	1.0	239	137	20
	Summer	3/0.5'	21	0.5	6	11	9.0	100	618	183	0.0	1.3	0.004				8	83	43	280
	Fall	1/0.5'	0.0	10.1	74	2.6	8.4	60	675	198	0.0	21.8	0.150				20	190	65	43
	Winter	3/2.5'	1.0	0.0	0.0	83	8.1	-	918	291	119	20.9	0.002	0.10	21.1	25.9	29	217	54	1,400
#3	Spring	3/1.5'	10	12.7	116	13	9.0	120	575	164	0.0	3.0	0.015	0.00	11.2	22.0	0.5	246	140	21
	Summer	3/0.5'	21	0.5	6	12	9.1	100	613	180	0.0	1.2	0.004				8	91	48	207
	Fall	1/0.5'	0.0	9.4	69	1.0	8.5	55	660	197	0.0	21.8	0.185				21	170	108	23
	Winter	3/2.5'	0.0	0.0	0.0	16	8.2	-	1060	449	42	1.7	0.006	0.10	-	16.3	18	98	27	23
#4	Spring	3/1.5'	9	9.6	88	3.1	8.7	97	520	200	0.0	1.0	0.006	0.00	0.0	7.8	0.5	26	30	0.620
	Summer	3/0.5'	22	1.7	20	3.4	9.0	90	627	255	0.0	0.8	0.003				5	17	22	0.820
	Fall	1/0.5'	0.0	12.1	88	2.3	9.2	132	520	314	0.0	0.7	0.086				5	29	22	0.036

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LABORATORY ANALYSES
Seasonal Survey 1955 (Continued)

MADDOCK, NORTH DAKOTA

STA.	SEASON	DATE SAMPLED /Depth	TEMP. °C	D.O. ppm	D.O. % Sat.	B.O.D. ppm	pH	ALKALINITY P ppm	ALKALINITY M ppm	CHLORIDES ppm	SULFATE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL PHOSPHATE ppm	PHOSPHATE ppm	PHOSPHATE ppm	TURB.	SOLIDS Susp. ppm	SOLIDS Diss. ppm	COLIFORM MPN/100 ml (to 1930)
	Winter	3/2.5'	0.0	11.4	83	2.9	8.6	59.6	131	354	0.0	0.7	0.002	0.10	1.3	4.6	4	12	12		0.030
#5	Spring	3/1.5'	9	9.8	90	2.1	8.7	87	478	224	0.0	0.7	0.009	0.00	0.0	4.0	1.0	15	29		0.050
	Summer	3/0.5'	21	6.9	81	4.3	9.5	88	435	256	0.0	0.5	0.002				5	12	30		0.030
	Fall	1/0.5'	0.0	12.1	88	1.7	9.5	145	445	288	0.0	0.7	0.060				1.2	<25	10		0.036
	Winter	3/2.5'	0.0	11.4	83	3.7	8.6	65.7	721	348	0.0	0.5	0.004	0.13	-	4.6	4	12	14		0.030
#6	Spring	3/1.5'	9	9.9	91	1.7	8.8	78	488	194	0.0	1.2	0.026	0.00	0.0	4.0	0.5	17	32		0.030
	Summer	3/0.5'	22	5.7	68	5.8	9.3	103	418	237	0.0	0.4	0.002				5	7	7		0.110
	Fall	1/0.5'	0.0	12.2	89	1.7	9.5	135	422	287	0.0	0.7	0.050				1.2	<25	6		0.000

REMARKS:

(1) See individual data sheets for remarks pertinent to each season.

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LABORATORY ANALYSES
Winter (Dec.) 1975

MADDOCK, NORTH DAKOTA

STATION	DATE	TIME	TEMP °C	D.O. ppm	D.O. % Sat	BOD (5) ppm	pH	ALKALINITY P	ALKALINITY T	CHLOR	SUL-	AMMONIA	NITRITE	NITRATE	TOTAL	PHOSPHATE		TURB.	SOLIDS	COLIFORM
Loca- tion Depth	1975													(N)						per 100ml (x 1000)
Raw	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7	Comp(1)	4	0.8	-	286	8.1	0	604	110	5	58.0	0.525	0.08	82.9	52.4	36	450	408	110,000
	8	" (1)	-	5.2	-	428	7.8	0	606	100	0.5	31.0	0.138	0.17	64.4	54.4	36	400	380	9,300
	Ave.	-	-	3.0	-	357	7.9	0	605	105	2.7	44.5	0.331	0.12	73.6	53.4	36	425	394	32,000 (4)
#1	5	1305	-	0.0	0	73	8.1	0	914	297	109	20.0	0.010	0.13	21.3	25.6	24	390	-	360
	7	0910	0	0.0	0	70	8.1	-	898	294	117	21.5	0.001	0.06	21.8	26.2	25	160	46	430
	8	0925	0	0.0	0	87	8.0	0	933	294	128	17.2	0.001	0.09	19.6	26.9	25	110	44	140
	Ave.	-	0	0.0	0	77	8.1	0	912	295	118	19.6	0.004	0.09	20.9	26.2	25	220	45	310
#2	5	1110	-	0.0	0	98	8.1	0	810	234	82	20.8	0.050	0.06	24.4	23.2	25	310	-	1,500
	7	0920	1	0.0	0	75	8.1	-	884	286	117	20.5	0.002	0.13	19.0	25.3	25	260	54	2,400
	8	0900	1	0.0	0	91	8.0	0	912	286	144	17.2	0.001	0.06	19.6	29.9	34	120	44	1,500
	Ave.	-	1	0.0	0	88	8.1	0	869	269	114	19.5	0.018	0.08	21.0	26.1	28	230	49	1,800
#3	5	1240	-	0.0	0	80	8.1	0	908	294	113	20.5	0.006	0.06	21.3	25.6	25	400	-	2,300
	7	0850	1	0.0	0	73	8.0	-	896	287	117	23.0	0.001	0.11	17.9	24.3	28	130	50	930
	8	0900	2	0.0	0	95	8.2	0	950	292	128	19.2	0.000	0.14	24.1	27.8	34	120	58	930
	Ave.	-	1	0.0	0	83	8.1	0	918	291	119	20.9	0.002	0.10	21.1	25.9	29	217	54	1,387
#4	5	1305	-	0.0	0	15	8.3	28.0	1040	445	41	0.4	0.016	0.06	-	15.8	18	65	-	<30.0
	7	0840	0	0.0	0	17	8.2	-	1040	447	45	1.9	0.001	0.11	-	15.7	18	100	21	9.3
	8	0840	0	0.0	0	15	8.1	-	1090	455	43	2.7	0.000	0.12	-	17.4	18	130	34	24.0
	Ave.	-	0	0.0	0	15	8.2	0	1057	449	42	1.7	0.006	0.10	-	16.3	18	98	27	23.1

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LABORATORY ANALYSES
Winter (Feb.) 1955 (Continued)

MADDOCK, NORTH DAKOTA

STATION Location* Depth**	TIME Feb. 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD(2) ppm	pH	ALKALINITY P ppm	ALKALINITY T ppm	CHLORIDES ppm	SULFATES ppm	AMMONIA ppm	NITRITE ppm	NITRATE (3) ppm	PO4 (3)	SILICATE (3)	SILICATE ppm	TOTAL ppm	OXYGEN ppm	COLIFORM MPN/100ml (x 1000)
#5	5	1300	-	11.6	85	4.2	8.7	56.0	732	352	0	0.8	0.004	0.04	1.3	4.60	2	15	-	-
	7	0825	0	11.2	82	2.2	8.5	48.8	725	355	0	0.7	0.002	0.19	-	4.52	5	10	18	<0.030
	8	0830	0	11.5	84	2.3	8.5	74.0	736	355	0	0.6	0.000	0.08	-	4.76	5	10	7	<0.030
	Ave.	-	0	11.4	84	2.9	8.6	59.6	731	354	0	0.7	0.002	0.10	1.3	4.63	4	12	12	<0.03
#6	5	1230	-	11.6	85	2.8	8.7	55.6	712	343	0	0.7	0.006	0.16	-	4.64	2	10	-	-
	7	0800	0	11.3	83	3.8	8.5	57.6	714	353	0	0.3	0.004	0.09	-	4.32	5	7	14	<0.030
	8	0820	1	11.4	84	4.4	8.6	58.0	738	349	0	0.4	0.001	0.13	-	4.72	6	20	15	<0.030
	Ave.	-	0	11.4	84	3.7	8.6	65.7	721	348	0	0.5	0.004	0.13	-	4.56	4	12	14	<0.03

* Location:
Raw: At lift station. Sample collected as flow entered wet well.
#1 : 125' from N and E bank (in #1 Pond)
#2 : #1 Pond; Directly over inlet.
#3 : #1 Pond; Approximately 25 ft. N. of outlet.
#4 : #2 Pond; 200 ft. South of inlet and 300 ft. from East bank.
#5 : #3 Pond; 50 ft. East of inlet.
#6 : #3 Pond; 125 ft. from North and West dikes.

** Depth

	Total	Ice	Sample
#1	3' 8"	2' 0"	2' 6"
#2	3' 4"	3"	2' 6"
#3	3' 7"	2' 1"	2' 6"
#4	3' 4"	2' 1 1/2"	2' 6"
#5	4' 6"	2' 1 1/2"	2' 6"
#6	5' 8"	1' 11 1/2"	2' 6"

NOTE: See Reference (5) under REMARKS

REMARKS:
(1) 24 hour composites collected at 2 hour intervals.
(2) All samples transported from Maddock to Wishek to Bismarck during incubation.
(3) Analysis made in Cincinnati.
(4) Geometric mean.
(5) Channel between Lagoons #2 and #3; Total, 25"; Ice, 25".

LABORATORY ANALYSES
Spring 1955

MADDOCK, NORTH DAKOTA

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STATION Location Depth	DATE 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	M.O. Alk.	P. Alk.	COLOR	SUS.	AMMONIA	ORTHO PHOS. ppm	NITRATE (2) ppm	TOTAL NIT. (3) ppm	PHOSPHATE		TURB	SOLIDS	COLIFORM
Raw	8-9	Comp(2)	5	6.03	-	136	7.9	0	630	182	0.0	7.0	0.306	0.00	41.4	32.8	1.0	180	140	4,300
	9-10	Comp(2)	5	6.00	-	163	7.60	0	600	-	-	-	-	-	-	-	-	212	316	4,300
	10-11	Comp(2)	-	5.80	-	113	7.90	0	650	-	-	-	-	-	-	-	-	165	436	930
	Ave.	-	5	6.0	-	137	7.8	0	627	182	0.0	7.0	0.306	0.00	41.4	32.8	1.0	286	297	2,510
#1	9	0515	9	9.44	81	14	9.0	120	560	188	0.0	4.55	0.012	0.00	11.8	21.2	1.0	311	228	39
	10	0620	9	11.50	105	29	8.80	115	600	-	-	-	-	-	-	-	-	206	72	23
	11	0555	11	18.40	175	18	9.20	175	625	-	-	-	-	-	-	-	-	186	112	28
	Ave.	-	9	13.1	120	20	9.0	137	595	188	0.0	4.55	0.012	0.00	11.8	21.2	1.0	234	137	28
#2	9	0525	9	10.31	95	18	8.9	125	590	160	0.0	4.45	0.015	0.02	11.5	20.0	1.0	320	188	15
	10	0615	9.5	11.10	103	17	8.70	115	570	-	-	-	-	-	-	-	-	206	96	23
	11	0550	11	16.40	156	9.5	9.20	165	595	-	-	-	-	-	-	-	-	190	128	23
	Ave.	-	9.8	12.6	118	14.8	8.9	135	585	160	0.0	4.45	0.015	0.02	11.5	20.0	1.0	239	137	20
#3	9	0530	9	8.18	75	14	9.0	100	550	164	0.0	3.0	0.015	0.00	11.2	22.0	0.5	330	176	21
	10	0607	10	11.00	103	17	8.80	120	520	-	-	-	-	-	-	-	-	234	92	21
	11	0545	11	19.00	181	6.9	9.20	140	585	-	-	-	-	-	-	-	-	175	152	23
	Ave.	-	10	12.7	119	13	9.0	120	575	164	0.0	3.0	0.015	0.00	11.2	22.0	0.5	246	140	21
#4	9	0540	9	9.50	87	[illegible]	8.75	10	500	200	0.0	0.95	0.006	0.00	0.0	7.8	0.5	50	40	0.930
	10	0600	9	8.80	81	3.1	8.50	195	525	-	-	-	-	-	-	-	-	15	38	0.910
	11	0540	11	10.45	100	3.1	8.80	85	535	-	-	-	-	-	-	-	-	12	12	<0.030
	Ave.	-	9	9.6	88	3.1	8.68	97	520	200	0.0	0.95	0.006	0.00	0.0	7.8	0.5	26	30	0.623

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LABORATORY ANALYSES
Spring 1971 (Continued)

MADDOCK, NORTH DAKOTA

STATION	DAY	TIME	DEPTH**	D.O.		B.O.D.	pH	ALKALINITY		COLOR	SUL-	AMMONIA	NITRITE	NITRATE	TOTAL	PHOSPHATE		TURB.	SOLIDS	COLIFORM
Location*				%	PPM		PPM								(1)	(1)				
															PPM	PPM	PPM			
	9	0585	9	10.00	92	1.4	8.8	70	440	224	0.0	0.75	0.009	0.00	0.0	4.0	1.0	30	48	0.091
#5	10	0555	9	9.70	89	1.7	8.55	105	500	-	-	-	-	-	-	-	-	8	20	<0.03
	11	0535	11	99.75	93	3.3	8.85	85	495	-	-	-	-	-	-	-	-	8	18	<0.03
	Ave.	-	9	9.8	90	2.1	8.7	87	478	224	0.0	0.75	0.009	0.00	0.0	4.0	1.0	15	29	0.05
	9	0550	9	9.90	91	1.3	8.85	60	470	194	0.0	1.20	0.026	0.00	0.0	4.0	0.5	25	76	-
#6	10	0585	9	10.00	92	1.7	8.70	95	520	-	-	-	-	-	-	-	-	15	10	<0.030
	11	0530	11	9.80	93	2.2	8.95	80	475	-	-	-	-	-	-	-	-	10	11	<0.03
	Ave.	-	9	9.9	91	1.7	8.77	78	483	194	0.0	1.20	0.026	0.00	0.0	4.0	0.5	17	32	<0.03

* Location:

Raw : At lift station. Sample collected as flow entered sump.
#1 : 125° from N and E bank in #1 Pond)
#2 : No. 1 Pond; directly over inlet.
#3 : No. 1 Pond, approximately 25 ft. North of outlet.
#4 : No. 2 Pond; 200 ft. South of inlet and 300 ft. from East bank.
#5 : No. 3 Pond; 50 ft. East of inlet.
#6 : No. 3 Pond; 125 ft. from North and West dikes.

REMARKS:

(1) Analysis made in Cincinnati

(2) 24 hour composites collected at 2-hour intervals.

** Depth:

#1]
#2]
#3] - All 1.5 ft.
#4]
#5]
#6]

LABORATORY ANALYSES

Summer 1955

MADDOCK, NORTH DAKOTA

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Station	Date	Time	Test	D.O.		BOD	pH	Alkalinity	Chlor-	Sul-	Ammonia	Nitrite	Nitrate	Total	Phosphate	Turb.	Solids	Coliform
Loca- tion			%	ppm		ppm		ppm	ides ppm	fate ppm	ppm	ppm	ppm	Hard- ness ppm	ppm			per 100 ml
		Comp.																
	15-16	24-hr.	-	-	-	428	7.75	4	580	121	0	17.6	0.341			30	288	260	23,000
Raw	16-17	"	-	-	-	506	7.75	50	550	77	0	14.1	0.132			30	295	330	15,000
	17-18	"	-	-	-	235	7.75	25	610	121	0	14.1	0.150			28	330	210	96,000
	Ave.	-	-	-	-	390	7.7	26	580	106	0.0	15.3	0.207			30	304	270	32,200
	16	0805	20	0.15	2	10.1	9.15	90	620	183	0	0.9	0.002			8	110	48	150
#1	17	0815	21	0.12	1	11.1	8.7	95	590	188	0	1.3	0.003			10	96	40	240
	18	0815	23	2.0	25	7.7	8.7	100	595	190	0	1.8	0.005			8	68	48	23
	Ave.	-	21	0.7	8	9.3	8.8	95	602	187	0.0	1.3	0.003			8	91	45	138
	16	0810	21	0.0	0	11.7	9.05	125	635	199	0	0.9	0.002			8	94	56	230
#2	17	0810	21	0.0	0	11.2	9.05	90	630	184	0	1.4	0.003			10	92	20	460
	18	0800	23	1.5	18	8.8	9.05	85	590	186	0	1.6	0.006			6	64	52	150
	Ave.	-	21	0.5	6	10.6	9.0	100	618	183	0.0	1.3	0.004			8	83	43	280
	16	0820	20	0.0	0	11.0	9.15	90	620	165	0	0.9	0.001			7	94	28	230
#3	17	0800	21	0.6	7	12.4	9.15	95	605	186	0	0.9	0.004			9	96	56	150
	18	0750	23	0.8	10	12.7	9.15	115	615	188	0	1.8	0.006			8	82	60	240
	Ave.	-	21	0.5	6	12.0	9.1	100	613	180	0.0	1.2	0.004			8	91	48	207
	16	0830	20	1.0	12	4.5	9.10	90	635	253	0	0.9	0.001			5	17	46	0.140
#4	17	0755	21	1.6	19	2.9	8.95	80	635	257	0	0.7	0.003			6	19	15	2.30
	18	0730	24	2.4	30	2.7	8.95	100	610	256	0	0.8	0.004			4	15	6	0.023
	Ave.	-	22	1.7	20	3.4	9.0	90	627	255	0.0	0.8	0.003			5	17	22	0.821

LABORATORY ANALYSES
Summer 1955 (Continued)

MADDOCK, NORTH DAKOTA

STATION Location * Depth**	DATE Aug. 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLOR-IDE ppm	SUL-FIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	16	0840	21	7.6	89	5.5	9.45	90	415	269	0	0.2	0.0003				4	4	4	0.043
#5	17	0750	21	5.6	66	3.5	9.60	75	460	248	0	1.0	0.0022				6	23	20	0.023
	18	0718	23	7.6	93	3.8	9.60	100	430	250	0	0.4	0.0034				5	8	67	0.023
	Ave.	-	21	6.9	81	4.3	9.5	88	435	256	0.0	0.5	0.002				5	12	30	0.030
	16	0850	21	6.0	71	7.0	9.50	110	350	225	0	0.2	0.0005				5	3	-	0.075
#6	17	0738	21	5.6	66	4.1	9.60	90	445	240	0	0.7	0.0014				5	10	10	0.023
	18	0710	24	5.4	67	6.4	9.60	110	460	247	0	0.3	0.0043				5	7	4	0.230
	Ave.	-	22	5.7	68	5.8	9.6	103	418	237	0.0	0.4	0.002				5	7	7	0.110

* Location:
Same locations as Winter run.

** Depth:
#1]
#2]
#3] - All 0.5 ft.
#4]
#5]
#6]

LABORATORY ANALYSES
Fall 1955

MADDOCK, NORTH DAKOTA

STATION	Raw	#1	#2	#3	#4	#5	#6
Date	11/2/55	11/2	11/2	11/2	11/2	11/2	11/2
Time Collected	Comp.	1000	0930	0900	0845	0810	0730
Depth	-	0.5	0.5	0.5	0.5	0.5	0.5
Temp. (°C)	-	0	0	0	0	0	0
D.O.	-	9.9	10.1	9.4	12.1	12.1	12.2
% Sat.	-	72	73	68	88	88	89
BOD	185	4.0	2.6	1.0	2.3	1.7	1.7
pH (field)	8.1	8.4	8.4	8.5	9.2	9.5	9.5
Alkalinity (P)	0.0	50	60	55	132	145	135
Alkalinity (M.O.)	590	670	675	660	520	445	422
Chloride	130	199	198	197	314	288	287
Sulfide	Trace	0.0	0.0	0.0	0.0	0.0	0.0
Ammonia	50.0	23.5	21.8	21.8	0.7	0.7	0.7
Nitrite	0.33	0.16	0.15	0.18	0.09	0.06	0.05
Nitrate							
Total Nitrogen							
Total Phosphate							
Ortho Phosphate	45.0	19.4	19.9	21.0	4.6	1.2	1.2
Turbidity	310	180	190	170	29	<25	<25
Suspended Solids	197	77.5	65	108	22	10	6
MPN (x 1000)	930	23	43	23	36	3.6	0.0

LABORATORY ANALYSES
Seasonal Summary 1955

WISHEK, NORTH DAKOTA

STA.	SEASON	DAYS SAMPLED /Depth	TEMP. °C	D.O. ppm	D.O. %Sat.	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	Winter	3	6	2.6	-	499	8.1	0	560	68	1.3	59	0.306	0.18	140	62.7	65	717	885	60,300
Raw	Spring	3	19	5.7	-	195	8.1	0	443	55	0.05	44.5	0.155	0.00	186	31.2	2	218	277	19,950
	Summer	3	-	-	-	219	7.6	0	430	54	0.0	24.0	0.172				19	186	137	42,000
	Winter	3/1.5'	-	0.0	0	132	7.7	0	631	98	125	60	0.221	0.11	65	48.3	48	203	87	2,230
#1	Spring	3/1.5'	15	8.9	95	51	9.4	80	343	82	0.0	44.5	0.060	0.00	28.9	26.8	2	485	248	99
	Summer	3/0.5'	22	0.4	5	24	8.8	32	291	74	0.4	1.5	0.014				6	149	75	-
	Winter	3/1.5'	0	0.0	0	157	7.5	0	779	126	47	62	0.000	0.09	68	63.9	55	293	85	2,600
#2	Spring	3/1.5'	15	8.7	93	51	9.5	78	402	76	0.0	26.8	0.057	0.00	29.9	24.8	1	489	237	244
	Summer	3/0.5'	22	3.8	46	28.4	9.1	38	282	74	0.0	1.2	0.007				4	141	67	-
	Winter	3/2.0'	-	0.0	0	1.44	7.6	0	925	157	59	63	0.001	0.10	62	60.1	60	317	66	2,243
#3	Spring	3/1.5'	15	9.0	96	50	9.5	73	413	79	0.0	25.2	0.062	0.00	29.4	25.2	1.5	440	237	112
	Summer	3/0.5'	22	3.3	40	19.1	9.2	38	287	75	0.0	1.5	0.003				5	143	75	-

LABORATORY ANALYSES (2)
Winter (Feb.) 1955

WISHEK, NORTH DAKOTA

STATION Location * Depth**	DATE Feb. 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE (3) ppm	TOTAL NITROGEN (3) ppm	PHOSPHATE Tot. (3) ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	10	1040	-	3.0	-	843	8.0	0.0	606	95	1.3	56	0.250	0.33	209	90	125	1200	1230	46,000
Raw	11	0950	7	2.0	-	403	8.1	-	568	59	2.3	68	0.394	0.11	131	62.0	50	550	780	110,000
	12	0955	5	2.7	-	250	8.1	-	506	50	0.4	54	0.275	0.11	81.2	36.0	20	400	644	43,000
	Ave.	-	6	2.6	-	499	8.1	0.0	560	68	1.3	59	0.306	0.18	140.4	62.7	65	717	885	60,300 (1)
	10	1020	-	0.0	0	156	7.7	0.0	527	80	0.8	58	0.187	0.15	63.3	41.6	48	180	102	2,100
#1	11	0945	-	0.0	0	107	7.7	0.0	[illegible]	82	5.7	60	0.475	0.14	59.9	48.4	48	190	[illegible]	2,300
	12	0925	-	0.0	0	134	7.6	0.0	783	132	31.1	61	0.000	0.04	70.6	54.8	48	240	78	2,300
	Ave.	-	-	0.0	0	132	7.7	0.0	631	98	12.5	60	0.221	0.11	64.6	48.3	48	203	87	2,230
	10	1010	0	0.0	0	153	7.5	0.0	702	112	21.4	61	0.000	0.14	68.6	54.0	48	260	94	2,400
#2	11	0935	-	0.0	0	171	7.5	0.0	772	119	48.6	63	0.000	0.08	63.8	67.6	60	260	66	3,900
	12	0955	-	0.0	0	146	7.6	0.0	864	147	70.0	62	0.000	0.04	70.6	70.0	56	360	96	1,500
	Ave.	-	0	0.0	0	157	7.5	0.0	779	126	46.7	62	0.000	0.09	67.7	63.9	55	293	85	2,600
	10	0950	-	0.0	0	161	7.5	0.0	903	150	54.5	57	0.001	0.12	60.5	45.6	56	330	80	930
#3	11	0920	-	0.0	0	129	7.6	0.0	936	158	62.2	68	0.000	0.08	66.6	67.2	68	300	48	4,300
	12	0845	-	0.0	0	142	7.6	0.0	936	163	60.3	64	0.001	0.10	60.5	67.6	56	320	70	1,500
	Ave.	-	-	0.0	0	144	7.6	0.0	925	157	59.0	63	0.001	0.10	62.5	60.1	60	317	66	2,243

(See continuation)

LABORATORY ANALYSES (2)
Winter (Feb.) 1955 (Continued)

WISHEK, NORTH DAKOTA

* Location:

Raw: M.H. Northeast of Imhoff Tank building.
#1 : 100' West of inlet.
#2 : Center of line between outlet and island.
#3 : 100' from outlet on line between outlet and island.

	** Depth		
	Total	Ice	Sample
#1	2' 9"	1' 5"	1' 6"
#2	2' 6"	1' 10"	1' 6"
#3	3' 5"	1' 11"	2' 0"

REMARKS:

(1) Geometric mean.
(2) Samples transported from Wishek to Bismarck for analysis (a 2-hour trip).
(3) Analyzed in Cincinnati.

LABORATORY ANALYSES
Spring 1955

WISHEK, NORTH DAKOTA

STATION Location ** Depth***	DATE May 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat.	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
	11-12	2P-8A*	19	4.3	-	168	8.2	0	420	55	0.051	44.5	0.155	0	186.5	31.2	2.0	168	212	23,000
Raw	12-13	8A-6A*	-	6.1	-	208	8.1	0	450	-	-	-	-	-	-	-	-	247	256	23,000
	13-14	8A-6A*	-	6.6	-	208	8.15	0	460	-	-	-	-	-	-	-	-	240	364	15,000
	Ave.	-	19	5.7	-	195	8.1	0	443	55	0.051	44.5	0.155	0	186.5	31.2	2.0	218	277	19,950
	12	0730	14	9.8	102	52	9.5	100	395	82	0	44.5	0.060	0	28.9	26.8	2.0	476	244	230
#1	13	0620	16	10.0	109	55	9.35	80	365	-	-	-	-	-	-	-	-	500	290	23
	14	0610	15	7.05	75	47	9.4	60	330	-	-	-	-	-	-	-	-	480	210	43
	Ave.	-	15	8.9	95	51	9.4	80	363	82	0	44.5	0.060	0	28.9	26.8	2.0	485	248	99
	12	0740	14	10.1	105	51	9.75	85	460	76	0	26.8	0.057	0	29.9	24.8	1.0	508	180	43
#2	13	0625	16	10.5	115	59	9.35	75	405	-	-	-	-	-	-	-	-	420	260	230
	14	0615	15	5.65	60	44	9.4	75	370	-	-	-	-	-	-	-	-	540	270	460
	Ave.	-	15	8.7	93	51	9.5	78	402	76	0	26.8	0.057	0	29.9	24.8	1.0	489	237	244
	12	0750	14	11.5	120	47	9.80	85	465	79	0	25.2	0.062	0	29.4	25.2	1.5	508	200	93
#3	13	0630	16	10.0	109	55	9.30	70	400	-	-	-	-	-	-	-	-	411	260	150
	14	0625	15	5.4	57	48	9.4	65	375	-	-	-	-	-	-	-	-	400	250	93
	Ave.	-	15	9.0	96	50	9.5	73	413	79	0	25.2	0.062	0	29.4	25.2	1.5	440	237	112

(See Continuation)

LABORATORY ANALYSES
Spring 1955 (Continued)

WISHEK, NORTH DAKOTA

* Composite

** Location:

Raw : M.H. Northwest of Imhoff Tank building.
#1 : 100' West of inlet.
#2 : Center of line between outlet and island.
#3 : 100' from outlet on line between outlet and island.

*** Depth

#1]
#2] All 1.5 ft.
#3]

LABORATORY ANALYSES
Summer 1955

WISHEK, NORTH DAKOTA

STATION Location * Depth**	DATE Aug. 1955	TIME	TEMP °C	D.O. ppm	D.O. %Sat	BOD ppm	pH	ALKALINITY P ppm	ALKALINITY Total ppm	CHLORIDE ppm	SULFIDE ppm	AMMONIA ppm	NITRITE ppm	NITRATE ppm	TOTAL NITROGEN ppm	PHOSPHATE Tot. ppm	PHOSPHATE Ortho ppm	TURB. ppm	SOLIDS Susp. ppm	COLIFORM MPN/100ml (x 1000)
Raw	18-19	Comp.	-	-		109	7.6	-	400	43	-	19.0	0.0238			20		116	100	23,000
	19-20	"	-	-		275	7.7	0.0	450	68	0.0	28.3	0.0043			24		194	163	75,000
	20-21	"	-	-		272	7.5	-	440	50	-	24.6	0.4875			14		248	148	43,000
	Ave.	-	-	-	-	219	7.6	0.0	430	54	0.0	24.0	0.172			19		186	137	42,000
	19	0730	23.5	0.0	0	41.7	8.98	40	310	77	-	0.8	0.000			9		135	103	230
#1	20	0735	22	0.0	0	14.1	9.2	22	258	73	0.4	2.6	0.002			5		146	52	4,600
	21	0615	21	1.10	13	16.8	8.3	35	305	73	-	1.1	0.0390			5		166	70	930
	Ave.	-	22	0.4	5	24	8.8	32	291	74	0.4	1.5	0.014			6		149	75	1,920
	19	0735	24	9.77	124	36.3	9.35	55	275	71	-	0.6	0.000			5		110	84	460
#2	20	0745	22	0.31	4	15.7	9.55	25	267	78	0.0	1.8	0.0014			4		144	48	230
	21	0610	21	1.30	16	33.1	8.35	35	305	74	-	1.3	0.0272			4		170	68	230
	Ave.	-	22	3.8	46	28.4	9.08	38	282	74	0.0	1.2	0.0075			4		141	67	307
	19	0740	24	8.31	105	22.9	9.50	65	275	73	-	0.6	0.000			4		95	58	240
#3	20	0750	22	1.75	21	9.1	9.65	20	271	75	0.0	1.9	0.0014			6		152	-	430
	21	0605	21	0.0	0	25.3	8.38	30	315	75	-	1.9	0.0067			6		182	93	2,400
	Ave.	-	22	3.3	40	19.1	9.18	38	287	75	0.0	1.5	0.0027			5		143	75	1,020

* LOCATION:
Raw M.H. NW of Imhoff Tank Building
#1 100' W of inlet
#2 Center of line between outlet and Island
#3 100' from outlet on line with Island

** DEPTH:
#1, #2, #3 All 0.5'

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APPENDIX D

Winter-Spring Transition at Six Ponds in North Dakota

FIELD OBSERVATIONS
During Winter - Spring Transition
1956

SIX PONDS, NORTH DAKOTA

Place	Beach		Center	Dunn Center	Elgin		New Town	Watford City	
Ponds	#1	#2			#1	#2		#1(North)	#2(South)
Population	1,461		492	246	882		1,300	1,371	
Population served	1,350		200	108	500		1,300	1,100	200
Pond Area (acres)	7.1	11.1	4.5	3.0	6.0	6.0	8.0	8.25	2.0
	Total 18.2				Total 12.0				
PE/acre	190	122	44	36	83	83	163	133	100
	74				42				
Observed Depth	8' - 4' 0 - 3' (#1 lowered to 4' by draining into #2 on March 24)		3½'	6½'	3' - 7' 0 - 5' (W.L. raised 4' by run-off. Drained to #2 on March 7)		4' - 2"	6.5'	New
Ice thickness (winter)	36"	-	38"	35½"	33"	-	41½"	40"	-
Ice melted - open water	Apr.18	(Sewage added March 24) March 30	Apr. 6	Mar.28	Apr. 6	(Sewage added March 7) Mar.30	Apr.10	Apr.11	(Very shallow new pond) Mar.27
First D.O. and no odor	May 26	Apr. 18	Apr.13	Apr.12	May 3	Apr.19	June 2	June 1	Apr.11
No. days to "recover"	38	19	7	15	27	10	53	50	15

D-1

FIELD OBSERVATIONS
During Winter - Spring Transition
1956

SIX PONDS, NORTH DAKOTA (Continued)

Place / Ponds	Beach #1	Beach #2	Center	Dunn Center	Elgin #1	Elgin #2	New Town	Watford City #1(North)	Watford City #2(South)
Chemical Change									
pH under ice	7.45	7.92	7.35	7.00	7.65	7.65	7.48	7.85	8.25
pH after recovery	8.35	9.35	9.48	8.55	9.20	9.75	8.40	8.92	9.85
Alk P under ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
after recovery	85.0	350.0	65	14.0	68.0	106.0	20.0	64.0	182.0
Alk MO under ice	1745	940	1240	520	945	945	1090	1650	250
after recovery	1780	1195	240	320	328	270	700	660	458
D.O. under ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
after recovery	10.8	33.5	23.2	21.3	27.9	27.5	14.6	22.0	16.85
Chloride under ice	192	61	93.5	21	286.5		435	105.0	25.0
after recovery	35	36	12	18	82	82	218	45.0	53.0
% decrease	81.7	-	87.2	-	71.4	-	49.9	57.1	-
BOD under ice	-	-	107	-	-		-	-	-
after recovery	-	-	7.5	-	29.0	21.5	-	-	-
% decrease			93.0			-			
Temp °C. under ice	0.5		0.5	1.5	0.5		1.0	0	
after recovery	14		5	5	7		15	19	

BEACH, NORTH DAKOTA

Summary of Winter - Spring Transition

1956

Population served 1350

Sewerage. . . . . Combined storm and sanitary sewer.
Pumped to pond.
No pretreatment
No industrial wastes

Pond (two cells)

	No. 1	No. 2
Area	7.1 acres	11.1 acres
Max. Depth	8 ft.	8 ft.
Inlet	Center	Center
Outlet	Center (back flow through inlet to pond No. 2 inlet)	None

Loading:

Only Pond No. 1 was used through the winter, and Pond No. 2 was dry until March 23. Estimated loading on Pond No. 1 was then 190 persons per acre.

Investigation:

The Beach installation was inspected five times during the winter-spring transition. Approximately 38 days were required for recovery of the first pond, and only one week for the second. Apparent causes of the long recovery time for the first pond were high loading and excessive depth.

March 9, 10: Only first pond in use; about eight foot total depth, with three foot ice cover. Second pond completely dry.

March 29: Sewage being applied to second pond. About four feet of first pond contents had been drained to second pond on March 23. Both ponds covered with ice on March 29, but ice on second pond was only two inches thick and slushy.

April 18: Second pond fully recovered, with 33.5 ppm dissolved oxygen. First pond still septic and malodorous. No ice on either pond.

May 14: Same conditions as on April 18, with strong contrast between two ponds. In addition to the contrast in color and odor, the surface of the first pond was glossy smooth, while four inch wavelets were in evidence on the second pond.

June 1: Both ponds fully recovered. According to Mr. Raduns, Superintendent of Water and Sewerage at Beach, the first pond had recovered by May 26.

BEACH, NORTH DAKOTA

Field Observations during Winter - Spring Transition

1956

Date	3/10/56	3/29/56		4/18/56		5/14/56		6/1/56	
Time	0900	1400		1700		1300		1500	
Air Temp, °C	-19	-6		6		18		24	
Sky	-	Overcast		Clear		Partly Cloudy		Partly Cloudy	
Wind Direction	NE	NW		NE		NW		SE	
Wind Vel.(MPH)	25-30	6-10		4-8		20-25		15-20	
Pond No.	1 (1)	2 (2)	1	2	1	2	1	2	
Surface	Ice	Ice (3)	Smooth	Smooth	Smooth	4" Wavelets	Smooth	Smooth	
Sample Depth	1' 0"	1' 0"	1' 0"	1' 0"	1' 0"	1' 0"	1' 0"	1' 0"	
Temp, °C	0	0	13.5	15.5	14.0	13.0	14.0	14.0	
Color	Dark	Cloudy	Dark	Lt.Green	Dark	Lt Green	Lt.Green	Lt.Green	
Odor	Strong Sulfide	Slight Sulfide	Strong Sulfide	None	Strong Sulfide	None	Musty	None	
pH	7.45	7.92	7.80	9.25	7.45	9.45	8.35	9.35	
Alk, P	0	0	0	120	0	355	85	350	
Alk, M.O.	1745	940	1755	990	1775	1020	1780	1195	
D. O.	0	0	0	33.5	0	16.8	10.8	21.5	
Chloride	192	61	52	70	35	36	-	-	
Sulfate	-	-	-	-	-	-	596	1035	

REMARKS:

(1) Complete ice cover except for approximately 25 feet around inlet. Ice thickness, 3' 0"; total depth, 8' 0"

(2) Pond No. 2 not used until March 23, when about 3 feet of No. 1 contents were drained into No. 2.

(3) Pond No. 2 covered with 2 inches of slushy ice.

CENTER, NORTH DAKOTA

Summary of Winter - Spring Transition

1956

Population served 200

Sewerage . . . . . Separate sanitary sewer.
Pumped to pond.
No pretreatment
No industrial wastes

Pond

Area	4.5 acres
Depth	5 ft.
Inlet	Center
Outlet	Surface overflow; liquid level not quite up to outlet level during period of observation.

Loading:

45 persons per acre (est.)

Investigation:

Eleven inspections were made at the Center installation. Rapid recovery (about seven days) may be attributed to the very light loading. One fish (Sucker), one foot long, and several fingerlings, all dead, were found on southeast shore on April 20.

CENTER, NORTH DAKOTA

Field Observations during Winter - Spring Transition

1956

Date	10/30/55	3/5/56	3/7	3/16	3/30	4/6	4/13	4/20	4/27	5/4	5/11
Time	1430	1200	1430	1400	1300	1310	1300	1200	1145	1130	1250
Air Temp, °C	15.0	-	-	7.2	1.7	0.0	14.4	21.1	1.1	12.8	18.9
Sky	Clear	Hvy.Fog	-	Clear	Clear	Overcast	-	Brt.Sun	Overcast	Overcast	Clear
Wind Direction	NW	NW	-	W	SE	NW	NW	Calm	N	SW	W
Wind Vel.(MPH)	Strong	-	-	15-20	15-20	25-30	15-20	Calm	15-20	10-15	20-25
Surface	-	Ice-38"	Ice	Ice	Ice	50% Ice	Slush	Smooth	Smooth	Smooth	Smooth
Sample Depth (Ft)	0.5	3.5	1.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Temp, °C	13.0	0.0	2.0	2.5	3.0	3.0	5.0	16.0	5.0	9.0	14.0
Color	-	Black	Black	Clear, dark	Clear, dark	Clear	Light Green	Brown-Green	Clear	Light Green	Light Green
Odor	None	Sulfide	Strong Sulfide	Same	Fishy	Slight Sewage	None	None	None	None	None
pH	9.35	7.35	7.35	7.65	7.35	7.55	7.55	8.55	8.85	9.30	9.48
Alk, P	65	0	0	0	0	0	0	25	32.5	62	40
Alk, M.O.	348	1240	965	705	135	140	150	195	225	230	238
D. O.	-	0	0	0	0	0	0.4	16.2	11.8	23.2	15.4
Chloride	90	-	93.5	80	15	30	12	49	19.6	22	40

DUNN CENTER, NORTH DAKOTA

Summary of Winter - Spring Transition

1956

Population served 200

Sewerage . . . . . Separate sanitary sewer.
Pumped to pond.
No pretreatment
No industrial wastes

Pond.

Area	3.0 acres
Depth	3-5 ft.
Inlet	Center
Outlet	Manually operated draw-down valve

Loading:

About 67 persons per acre

Investigation:

Four inspections made. This pond recovered even before all ice had melted. Level had been drawn down four inches last fall and two feet this spring (prior to transition inspection). A ten-inch live Bucker had been caught in the effluent last fall.

DUNN CENTER, NORTH DAKOTA

Field Observations during Winter - Spring Transition

1956

Date	3/15/56	3/28	4/12	5/3
Time	1530	1000	0800	1530
Air Temp, °C	2.2	-6.7	11.7	12.2
Sky	Overcast	Overcast	Clear	Clear
Wind Direction	SW	W	SE	W
Wind Vel.(MPH)	20	25-35	15-17	25-30
Surface	Ice, 35½"	Slush, 2"	½ ice cover	Streaks
Sample Depth (Ft.)	2.0	1.0	0.5	0.5
Temp, °C	2.0	1.5	5.0	8.0
Color	Clear-brown	Clear-brown	None	Green
Odor	Slight sewage	None	None	None
pH	7.00	7.20	7.70	8.55
Alk, P	0.0	0.0	0.0	14.0
Alk, M.O.	520	360	315	322
D. O.	0.0	0.0	21.3	13.8
Chloride	21	25	15	18

ELGIN, NORTH DAKOTA

Summary of Winter - Spring Transition

1956

Population served 500

Sewerage. . . . . Separate sanitary; however, run-off from area around pond drains into lagoon through inlet manhole.

Gravity flow
No pretreatment
No industrial wastes

Pond (two cells)

	No. 1	No. 2
Area (acres)	6.0 acres	6.0 acres
Depth	3-8 ft.	4 ft.
Inlet	Center	West dike (from No. 1 pond)
Outlet	East dike; draw down to No. 2 pond	Surface, at 4 ft. level

Loading: (first pond)

About 83 persons per acre

Investigation:

Sixteen inspection trips were made to the Elgin installation. Large quantities of surface run-off complicated the recovery pattern. Whereas the first pond had retained the entire flow through the winter months, the run-off filled both ponds and caused a high rate of discharge from the second pond during the transition period. Twenty-seven days were required for the first pond to recover; the second pond had recovered within thirteen days after complete ice melt.

ELGIN, NORTH DAKOTA

Field Observations During Winter - Spring Transition

1956

Date	11/4/55	3/2/56	3/6	3/7	3/16	3/30	4/6	4/12	4/13	4/19	4/20	4/26	4/27	5/3	5/4	5/12
Time	1500	1400	1430	1030	1000	0800	0800	1730	0800	1930	0645	1900	0700	1830	0700	1400
Air Temp, °C	17.8						-5.6	10.6	12.8	17.8	4.4	-	-6.7	-	1.7	-
Sky	Clear		Not pertinent during complete ice cover				Overcast	-	-	-	-	-	Overcast	-	Overcast	Clear
Wind Direction	--						NW	S	-	Calm	Calm	-	N	-	Calm	-
Wind Vel.(MPH)	--						25-30	15-17	23	"	"	-	20-30	-	"	
POND NO.1																
Surface	Ice(1")	Ice(33")	Ice	Ice	Ice	Ice	Streaks	IceCrust	Smooth	Smooth	Smooth	Smooth	Streaks	-	Smooth	-
SampleDepth(Ft)	1.0	0.5	2.75	Effl.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Temp, °C	7.0	0.0	0.0	3.0	2.0	2.0	2.5	6.0	5.0	14.0	9.0	10.0	4.2	7.2	6.0	15.0
Color	Green	Brown-Gray	-	-	Clear Brown	Cloudy	None	Clear Gray	None	Gray	Gray	Gray	Gray	Gray	Gray	Light Green
Odor	None	Faint Sewage	None	Strong Sulfide	Sulfide	Faint Sewage	None	None	None	None	None	Urine Sulfide	Sulfide	Faint Sewage	Faint Sewage	Slight Fishy
pH	9.80	7.90	7.65	7.75	7.65	7.95	7.75	7.45	7.55	7.80	7.75	7.75	7.75	7.75	7.80	9.20
Alk,P	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68.0
Alk,M.O.	312	580	300	945	570	140	160	180	180	245	240	270	297	322	318	328
D. O.	23.6	0	0	0	0	0	0.7	0	0	0	0	0	0	0.5	0	27.9
Chlorides	112	286	91	158	145	32.5	32	80	54	-	72	56	-	-	66	82
POND NO.2	Dry	Dry	Dry	-												
Surface				-	Ice(6")	Ice (3")	Streaks	Smooth	Smooth	Smooth	Smooth	Smooth	Streaks	-	Smooth	-
SampleDepth(Ft)			From No.1		1.5	1.0	1.0	Effl.	Effl.	Effl.	Effl.	Effl.	Effl.	Effl.	Effl.	Effl.
Temp, °C				3.0	2.0	2.0	3.0	10.0	8.0	14.0	9.0	9.5	5.0	8.0	5.0	14.0
Color				-	Clear	Gray	None	Clear-Brown	None	Brown	Brown	Brown-Green	Brown Green	Green	Green	Light Green
Odor				Strong Sulfide	Sulfide	Sewage	None	None	None	None	None	None	None	None	None	None
pH				7.75	7.75	7.85	8.15	7.70	7.65	7.95	7.75	8.35	8.28	9.10	9.15	9.75
Alk,P				0	0	0	0	0	0	0	0	Trace	0	46	58	106
Alk,M.O.				945	505	340	300	325	320	305	305	305	302	296	284	270
D. O.				0	0	0	0.9	0	0	1.4	0.1	14.1	11.9	27.5	27.5	25.0
Chlorides				158	130	Trace	65	75	76	-	76	69	-	-	73	82

NEWTOWN, NORTH DAKOTA

Summary of Winter - Spring Transition

1956

Population served 1300

Sewerage . . . . . Separate sanitary
Gravity flow
No pretreatment
No industrial waste

Pond

Area	8 acres
Depth	3.5 ft.
Inlet	Center
Outlet	Bottom (overflow manhole)

Loading:

Estimated 163 persons per acre.

Investigation:

The Newtown installation was inspected six times during the winter - spring transition. Of the six ponds subjected to the transition study, the one serving Newtown required the longest time to recover, 53 days. Apparent causes were obstruction to the prevailing wind and high loading.

NEWTOWN, NORTH DAKOTA

Field Observations During Winter - Spring Transition

1956

Date	3/14/56	3/27	4/10	5/2	5/15	6/2
Time	0900	1430	1400	1820	0800	0850
Air Temp, °C	-8.9	0.6	10.0	4.4	12.8	23.3
Sky	-	Overcast	Partly Cloudy	Overcast	Clear	Clear
Wind Direction	E	NW	NW	NW	NW	Calm
Wind Vel.(MPH)	10	15-20	15-20	-	-	"
Surface	Ice (4$1\frac{1}{2}$")	7/8 Ice Cover	Ice (slushy)	Ice (slushy)	Smooth	Smooth
Sample Depth (Ft.)	3.5	1.0	Effluent	Effluent	Effluent	Effluent
Temp, °C	1.0	2.0	6.0	7.0	13.0	18.5
Color	Dark	Gray	Gray	Clear	Dark	Light Green
Odor	Sulfide	Sulfide	Sulfide	Sulfide	Strong Sulfide	None
pH	7.48	7.75	7.85	8.15	8.10	8.40
Alkalinity (P)	0	0	0	0	Trace	20
Alkalinity (M.O.)	1090	615	325	590	676	702
D. O.	0	0	0	0	0	14.6
Chloride	435	190	130	178	190	218

WATFORD CITY, NORTH DAKOTA

Summary of Winter - Spring Transition

1956

(North Pond) */

Population served . . . . . 1100 (est.)

Sewerage . . . . . Separate sanitary
Pumped to pond.
No pretreatment
No industrial wastes

Pond.

Area	8.25 acres
Depth	8 ft.
Inlet	Center
Outlet	Manual draw down in East dike

Loading:

Estimated 134 persons per acre

Investigation:

Seven inspection trips were made to the Watford City installation. Approximately 50 days were required for recovery. Pond was filled to top of dikes, indicating a depth well over eight feet; excessive depth was apparent cause of delayed recovery.

*/ Although Watford City has three ponds, only one was used through the winter months. Of the other two, one is newly constructed with only a few house connections and the other used only for occasional by-passed sewage at the lift station of the North pond.

WATFORD CITY, NORTH DAKOTA

Field Observations During Winter - Spring Transition

1956

Date	3/14/56	3/27	4/11	5/3	5/14	6/1	6/2
Time	1730	1400	1330	1000	1820	2030	0430
Air Temp, °C	-6.7	-1.1	7.2	10.0	15.6	15.6	12.2
Sky	-	Clear	Partly Cloudy	-	Sun & showers	-	-
Wind Direction	NE	NW	NW	-	NW	-	NE
Wind Vel. (MPH)	5-10	20-30	15-25	-	20-25	-	Light air
			NORTH POND - No. 1				
Surface	Ice (40½")	Ice	Ice	Smooth	Streaks	-	Smooth
Sample Depth (Ft.)	3.5	1.0	1.0	1.0	1.0	1.0	1.0
Temp, °C	0.2	0.5	6.5	6.0	16.0	19.0	17.0
Color	Dark	Clear	Cloudy	Dark	Brown-Green	Vivid Green	Vivid Green
Odor	Slight Sulfide	Musty	Slight Sulfide	Strong Sulfide	Strong Sulfide	None	None
pH	7.85	8.25	7.75	8.05	7.95	8.92	8.85
Alkalinity (P)	0	0	0	0	0	64	62
Alkalinity (M.O.)	1650	85	130	625	648	665	660
D. O.	0	0	0	0	0	22.0	18.5
Chloride	105	2.0	21	38.5	70	50	44

APPENDIX E

Descriptive Data on
All Dakota Ponds Constructed
To June 1956

Descriptive Data
Sewage Stabilization Ponds
NORTH DAKOTA
June 1956

Source / Place / Population	Applied Sewage / Kind / F.E.	Date Constructed	Pond: Number Cells / Operation	Pond: Area (Acres)	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only: Tot./per Cap.	Costs: Pond + Lift Sta. & Force Main: Tot./ per Cap.	Remarks
Asc. Abbey Winter-260 Summer- 60	Raw 260 60	Fall 1953	1	1.25	Center Gravity	None			Private school
Beach 1461	Raw 1350	Fall 1953	2 Series	#1 7.1 #2 11.1 T. (18.2)	Center Pumped	None	9,400 6.43	25,080 17.10	
Bisbee 365	Raw 350	Summer 1953	1	13.0	Center Pumped	N Overflow	9,030 24.80	31,600 86.60	
Butte 272	Raw 250	Fall 1951	1	1.03	Center Gravity	N Overflow	3,400 12.50	None	
Cavalier 1459	Raw 1450	Fall 1954	2 Series	#1 9.0 #2 8.0 T.(17.0)	Center Pumped	None	28,510 19.50	77,550 53.10	
Center 492	Raw 300	--- 1954	1	4.5	Center Pumped	3 Overflow	3,500 7.10	14,500 29.50	
Devils Lake 6427	Raw 11,650	Spring 1956	1	107	Center Pumped	None planned	48,000 7.47	200,000 31.20	New
Dunn Center 246	Raw 200	Winter 1955	1	3.0	Center Pumped	SW Draw-down	3,690 15.00	12,860 52.20	

Descriptive Data
Sewage Stabilization Ponds
NORTH DAKOTA
June 1956

Source	Applied Sewage	Pond			Inlet	Outlet	Costs		Remarks
Place Population	Kind P.E.	Date Constructed	Number Cells operation	Area (Acres)	Location Type	Location Type	Pond only Tot./perCap.	Pond + Lift Sta. & Force Main Tot./ per Cap.	
Dunseith 713	Raw 700	Spring 1956	1	4.0	Center Gravity	S Overflow	10,900 15.30	None	New
Elgin 852	Raw 500	June 1954	2 Series	#1 6.0 #2 6.0 T.(12.0)	Center Gravity	E & W #1 draw-down #2 overflow	9,510 10.80	None	
Fessenden 917	Raw 700	____ 1928	1	12	Side Gravity	None			Former slough
Flasher 413	Raw 300	Spring 1954	1	6.0	Center Pumped	S Draw-down	7,420 18.00	25,350 61.30	Needs bottom seal
Flaxton 436	Raw 350	____ 1953	2 Parallel	#1 3.0 #2 3.0 T.(6.0)	Side Pumped	N Overflow			
Fordville 376	Raw 310	Fall 1955	1	4.0	Center Pumped	SE Overflow	4,965 13.20	17,310 46.10	New
Fort Berthold Indian Res.									
West School 240	Raw 240		1	2	Center				

Descriptive Data
Sewage Stabilization Ponds
NORTH DAKOTA
June 1956

Source / Place / Population	Applied Sewage: Kind / P.E.	Date Constructed	Pond: Number Cells / Area (Acres) / operation	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only: Tot./Cap.	Costs: Pond + Lift Sta. & Force Main: Tot./ Cap.	Remarks
Fort Berthold Indian Res.(Cont.)								
East School 240	Raw 240		1 — 1	Center				
South School 100	Raw 100		1 — 1	Center				
Golva 174	Raw 160	____ 1953	1 — 1.9*	Center Pumped	None	960 5.50	10,125 58.20	*Being Modified
Grenora 525	Imhoff Eff. 500	____ 1949	1 — 3.0	Side				
Hazelton 453	Raw 450	Spring 1956	1	Center Gravity	N Overflow	7,100 15.70	None	New
Hope 470	Raw 475	____ 1951	1 — 10	Center Pumped	None			Needs bottom seal
Jamestown 10,697	Raw 12,550	Fall 1953	1 — 135	Center Pumped	NW Overflow	100,000 9.40	500,000 46.80	

Descriptive Data
Sewage Stabilization Ponds
NORTH DAKOTA
June 1956

Source / Place / Population	Applied Sewage / Kind / P.E.	Date Constructed	Pond: Number Cells / operation	Pond: Area (Acres)	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only / Tot./perCap.	Costs: Pond + Lift Sta. & Force Main / Tot./per Cap.	Remarks
Larimore 1374	Raw 3320	Spring 1953	1	9.0	Center Pumped	None	9,000 6.55	38,000 27.60	
Maddock 741	Raw 1750	____ 1949	3 Series	#1 11.7 #2 12.3 #3 8.0 T. (32.0)	Center Pumped	None	17,500 23.60	37,650 50.80	Included in seasonal research
Max 465	Raw 400	____ 1953	1	1.5	Side Gravity	SW Overflow	2,500 4.40	None	
Medina 564	Raw 500	Fall 1953	1	4.0	Center Gravity				
Minnewaukan 443	Raw 350	Dec. 1954	1	13.0	Center Pumped	N Overflow	11,200 25.30	78,365 177.00	
Minto 592	Raw 500	Fall 1954	1	7	Center Pumped	W Draw-down	5,200 8.80	44,900 75.90	
Neche 615	Raw 700	July 1955	1	16	Center Pumped	NE Draw-down	8,530 13.90	32,680 53.10	Still filling
New England 1117	Raw 1740	____ 1954	1	13.0	Center Pumped	E Draw-down	11,060 9.90	29,366 26.30	Being modified

Descriptive Data
Sewage Stabilization Ponds
NORTH DAKOTA
June 1956

Source: Place / Population	Applied Sewage: Kind / P.E.	Date Constructed	Pond: Number Cells - operation	Pond: Area (Acres)	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only Tot./per Cap.	Costs: Pond + Lift Sta. & Force Main Tot./ per Cap.	Remarks
New Salem 942	Raw 890	1955	1	10.5	Center Gravity	SW Draw-down	14,300 15.80	None	Still filling
New Town (1300)	Raw (1300)	June 1951	1	8	Center Gravity	S Overflow			
Northwood 1182	Raw 1110	1954 1956	2 Series	#1 6 #2 6 T. (12)	Center Pumped	None			
Park River 1692	Raw 1600	1955	2 Series	32.6	Center Pumped	#1 Overflow #2 None	42,360 25.00	113,250 67.00	
Plaza 389	Raw 350	1955	1	5.0	Center Pumped	E Overflow	8,100 20.80	30,075 77.30	Still filling
Portland 641	Raw 800	1951 1955	1	#1* 8.0 #2 6.0	Center Pumped	None	18,400 28.80		*First pond abandoned (1955)
Rolette 451	Raw 400	Fall 1954	1	12.0	Center Pumped	NW Draw-down	8,550 19.00	40,710 90.30	

Descriptive Data
Sewage Stabilization Ponds
NORTH DAKOTA
June 1956

Source: Place / Population	Applied Sewage: Kind / P.E.	Pond: Date Constructed	Pond: Number - Cells / Area (Acres) / operation	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only: Tot./Cap.	Costs: Pond + Lift Sta. & Force Main: Tot./perCap.	Remarks
Rolla 1176	Raw 1100	Fall 1954	1 — 11.0	Center Pumped	Overflow	6,300 5.40	31,900 27.20	Second pond planned for immediate construction
Scranton 360	Raw 350	____ 1956	1 — 4.0	Center Pumped	SW Draw-down	4,040 11.20	21,375 59.30	New
Stanley 1486	Raw	____ 1955	1 — 12	Center				
Watford City 1371	Raw 1300	1953 1954	Series (1 #2 2 (1 #1 8.0	Center-G Center-FM	E-Draw-down E-Draw-down	14,119 10.30	18,219 13.50	
		(1955)	(1 South 2.0) T. (12.0)	(Center-G	E-Draw-down)			Still filling
Wildrose 430	Raw 400	____ 1954	1 — 10	Center				
Wishek 1241	Raw 1490	____ 1952	1 — 7.8	25' off-shore Gravity	NW Draw-down	5,400 4.40		Included in seasonal research
Zeeland 484	Imhoff Eff. 500	____ 1952	1 — 1.5	Side Pumped	NW Overflow	4,000 8.30	37,000 76.40	

Descriptive Data
Sewage Stabilization Ponds
SOUTH DAKOTA
June 1956

Source / Place / Population	Applied Sewage: Kind / P.E.	Date Constructed	Pond: Number Cells / Area (Acres) / operation	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only Tot/perCap.	Costs: Pond + Lift Sta. & Force Main Tot/perCap.	Remarks
Beresford 1686	Raw 1600	Summer 1955	2 16.5 Series	Center Gravity	NW Overflow	17,265 10.24		--
Bison 457	Raw 300	Fall 1954	1 3.0 ---	Side Gravity	NE Overflow	-- --	None	--
Bonesteel 485	Raw 450	Summer 1955	1 5.4 ---	Center Gravity	N Overflow	10,325 21.29	None	--
(Bowdle)* 788	Raw 700	Planned	1 8.6 ---	Center Gravity	S Overflow	-- --	None	*Planned
Burke 829	Imhoff Eff. 975	Fall 1953	2 8.2 Series	Center Gravity	NE Overflow	12,000 14.48	None	--
(Canton)* 2530	Raw 2400	Planned	2 30 Series or Parallel	Center Pumped	SE	No Data	N. D.	*Planned
Cheyenne Indian Agency Cherry Cr. School 5 to 60	Septic Tank 5 to 60	Fall 1953	2 0.34 Series or Parallel	Side Gravity	SE Overflow	No data	None	--

Descriptive Data
Sewage Stabilization Ponds
SOUTH DAKOTA
June 1956

Source / Place / Population	Applied Sewage Kind / P.E.	Pond Date Constructed / Operation	Pond Number Cells / Area (Acres)	Inlet Location / Type	Outlet Location / Type	Costs Pond Only Tot./per Cap.	Costs Pond + Lift: Sta. & Force Main Tot./per Cap.	Remarks
Cheyenne Indian Agency White Horse School 15 to 75	Septic Tank 5 to 69	Summer 1953	2 Series or Parallel	0.36 Side Gravity	E Overflow	No data	None	--
Clear Lake 1105	Raw 1200	Fall 1955	1 ---	12.0 Center Gravity	SE Overflow	14,500 13.12	None	--
Freeman 944	Imhoff Eff. 1225	Winter 1955	1 ---	9.0 Center* Gravity	NE Overflow	425 13.16	None	*Two inlets
Gettysburg 1955	Raw 1500	Fall 1955	2 Series	20.0 Center Gravity	W Overflow	23,763.80 15.30	None	---
Gettysburg USAF- Weather Station 175	Raw	Fall 1955	2 (3.85 & 2.0) Series or Parallel	Center Gravity	SW Overflow	No data	None	
Hayti 413	Raw 400	Fall 1953	2 Series or Parallel	5.0 Center Pumped	NE & SE Overflow	15,670 37.94	82,338* 206.63	*Includes new sewer system
Isabel 511	Raw 475	Summer 1955	1 ---	2.7 Center Gravity	NW Overflow	7,000 13.70	None	--
Kadoka 584	Raw Winter-550 Summer-850	Fall 1953 & Spring 1956	2 (3.0 & 5.2) Series or Parallel	Side-Center Gravity	NW & SW Overflow	6,900 11.82	None	--

Descriptive Data
Sewage Stabilization Ponds
SOUTH DAKOTA
June 1956

Source / Place / Population	Applied Sewage: Kind / P.E.	Pond: Date Constructed	Pond: Number Cells / Area (Acres) / operation	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only: Tot./per Cap.	Costs: Pond + Sta. & Lift Main: Tot./per Cap.	Remarks
Longford 456	Raw 450	Planned	1 5.3 ---	Center Pumped	NE Overflow	No data	No data	Planned
Lemmon 2760	Raw 2600	Summer 1951	1 27.1 ---	Center Gravity	SE Overflow	33,783 12.20	None	--
Murdo 739	Raw 730	Spring 1956	1 9.1 ---	175' from N Gravity	SE Overflow	24,000 32.60	None	--
New Effington 367	Raw 200	Spring 1954	2 - (2.1 & 1.6) Series	Center Pumped	NE Overflow	10,600 28.90	57,000* 156.30	*Includes new sewer systems
Oahe Adm. 100-200	Raw 150	Fall 1954	2 - (.44 & .44) Series or Parallel	Center Gravity	S Overflow	No data	None	--
Philip 810	Raw 750	Summer 1953	2 5.7 Series	Center Pumped	E Overflow	5,276 6.52	39,000 48.15	Isotope flow study here
Pierre Indian School 503	Raw 500	Summer 1955	1 5.1 ---	Center Pumped	SW Overflow	No data	No data	
Pollock 395	Raw 350	Summer 1955	2 - (2.3 & 2.3) Series	Center Gravity	NE Overflow	10,122 25.60	None	
Redfield 2655	Raw 2950	Fall 1955	1 30.2 ---	Center Pumped	SE Overflow	28,650 10.80	37,890 14.27	--

Descriptive Data
Sewage Stabilization Ponds
SOUTH DAKOTA
June 1956

Source	Applied Sewage	Pond		Inlet	Outlet	Costs		Remarks
Place Population	Kind P.E.	Date Constructed	Number Cells operation	Area (Acres)	Location Type	Location Type	Pond only Tot./perCap.	Pond + Lift Sta & Force Main Tot./per Cap.	
Rosebud Agency School/100-200	Sep.Tnk.Eff.	Summer 1954	4 Series	0.78	Center Pumped	____ Overflow	No data	No data	--
Sisseton 2871	Raw 3000	Summer 1955	2 - (16 & 11) Parallel		Center Gravity	N Overflow	44,586 15.53	None	--
Tabor 373	Raw 350	Spring 1956	1 ---	4.96	Center Pumped	NE Overflow	No data	No data	
Valley Springs 389	Raw 375	Summer 1956	2 - (3.85 & 2) Series or Parallel		Center Gravity	NW Overflow	9,750 25.00	None	--
Veblen 476	Imhoff Eff. est. 500	Summer 1954	2 - (1.4 & 1.1) Series or Parallel		30' N--SE corner Pumped	N Overflow	7,056 14.80	13,000 27.31	--
Wall 556	Raw Winter-500 Summer-1000	Fall 1951	1 ---	8.87	Side Gravity	SE Overflow	11,000 19.80	None	--
Wasta 144	Sep.Tnk.Eff. 15 & tourists (140)	____ 1953	1 ---	0.5	Side Gravity	None	No data	None	Privately owned and operated

Descriptive Data
Sewage Stabilization Ponds
SOUTH DAKOTA
June 1956

Source: Place / Population	Applied Sewage: Kind / P.E.	Pond: Date Constructed	Pond: Number Cells - operation	Pond: Area (Acres)	Inlet: Location / Type	Outlet: Location / Type	Costs: Pond only Tot./perCap.	Costs: Pond + Lift Sta. & Force Main Tot./per Cap.	Remarks
Bethesda* / Home/175	Raw / 175	Summer / 1956	1 / ---	1.8	Center / Gravity	NE / Overflow	No data	None	*In Beresford
Eagle Butte / 375	Raw		1 / ---	8.4					
Weaver / 50	Raw	1955	1 / ---	0.5	Center	____ / Overflow			Privately owned and operated
White River / 465			1 / ---	5.0	Center	____ / Overflow			Planned
Castlewood / 500	Raw / 1100	Planned	2 - (7.6 & 8.4) / Series or Parallel		Center / Pumped	NW or SW / Overflow			